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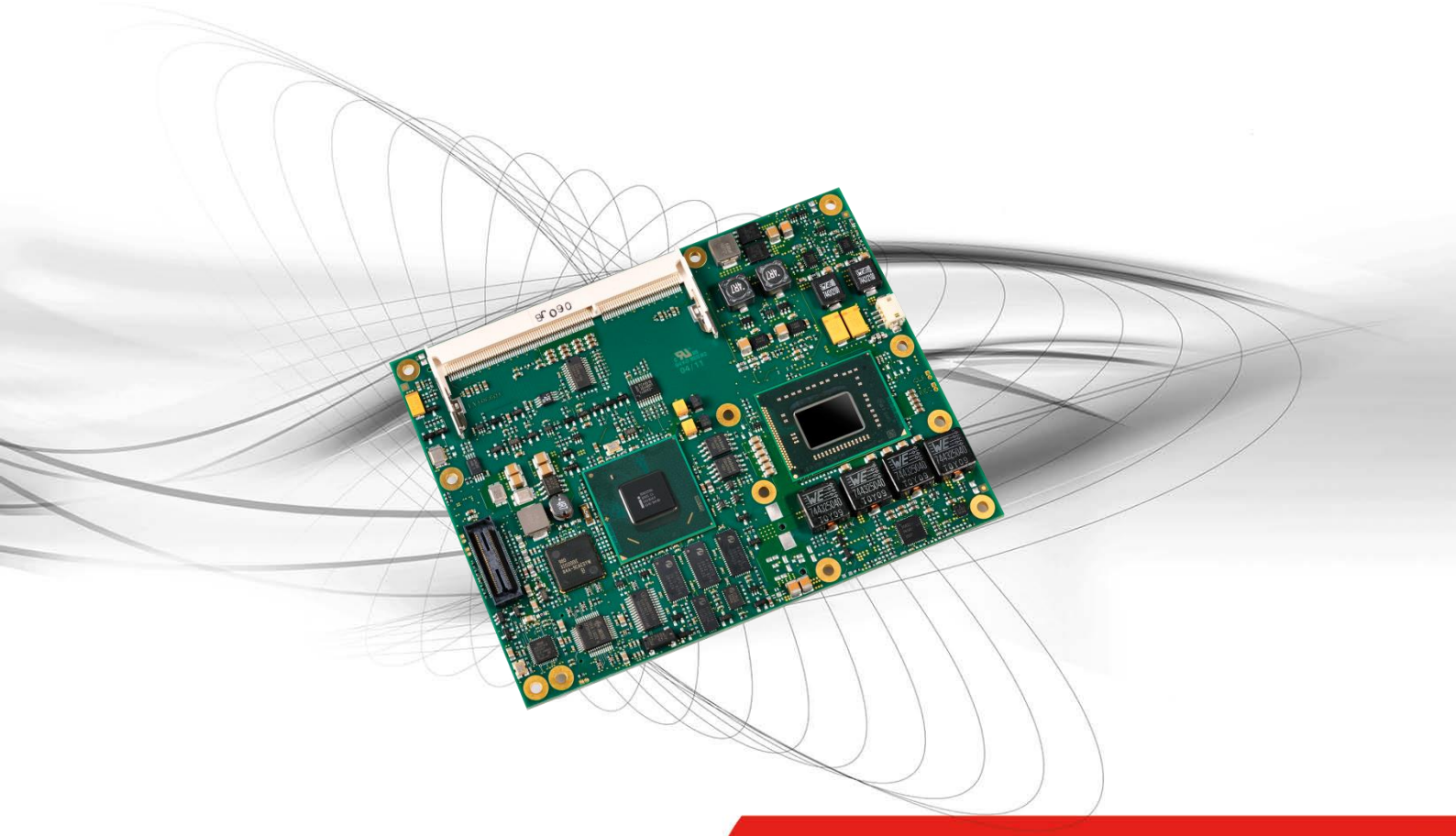

Engineering Leadership

User Manual

COM Express™ Basic Module
MSC C6B-7S

Type 6 Pin-out
3rd Generation Intel® Core™ Processor Family
Intel® 7 Series Chipset

Rev. 1.8

2015-04-15

Preface

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1 General Information

1.1 Revision History

Rev.	Date	Description
1.0	2013-04-24	Release Version
1.1	2013-05-28	Added additional information
1.2	2013-06-25	Signals FAN_PWMOUT and WAKE1# set to be supported
1.3	2013-07-01	Added additional I2C bus information, DDI1 Note
1.4	2013-09-06	SDIO support removed
1.5	2014-06-20	Block diagram updated
1.6	2014-09-04	New covering page
1.7	2014-12-23	Corrected Recovery Link
1.8	2015-04-15	Pull-up/-down description changed in chapter 2.10

1.2 Reference Documents

[1] COM Express Module Base Specification
COM Express Revision 2.1
Last update: April 10th, 2012

[2] PCI Local Bus Specification Rev. 2.1
PCI21.PDF
Last update: June 1st, 1995
http://www.pcisig.com

[3] ATA/ATAPI-6 Specification
d1410r3b.pdf
http://www.t13.org/

[4] Serial ATA Specification
Serial ATA 1.0 gold.pdf
Last update: August 29th, 2002 Rev.1.0
http://www.sata-io.org/

[5] IEEE Std. 802.3-2002
802.3-2002.pdf
http://www.ieee.org

[6] VESA Embedded DisplayPort Standard
eDP_v1_3 mem.pdf
Last update: 13.01.2012
http://www.vesa.org/

[7] Universal Bus Specification
usb_20.pdf
Last update: April 27th, 2000
http://www.usb.org

[8] Universal Serial Bus Revision 3.0 Specification
usb_30_spec_xxxxxx.zip
Last update: 13.08.2012
http://www.usb.org

[9] Mobile 3rd Generation Intel® Core™ Processor Family Datasheet – Volume 1 of 2
3rd-gen-core-family-mobile-vol-1-datasheet.pdf
Last update: September 2012
http://www.intel.com/content/www/us/en/processors/core/CoreTechnicalResources.html

[10] Mobile 3rd Generation Intel® Core™ Processor Family Datasheet – Volume 2 of 2
3rd-gen-core-family-mobile-vol-2-datasheet.pdf
Last update: June 2012
http://www.intel.com/content/www/us/en/processors/core/CoreTechnicalResources.html

[11] Intel ® 7Series / C216 Chipset Family Platform Controller Hub (PCH) Datasheet
7-series-chipset-pch-datasheet.pdf
Last update: June 2012
http://www.intel.com/content/www/us/en/chipsets/7-series-chipset-pch-datasheet.html?wapkw=intel+7+series+chipsets

[12] Intel ® 7Series / C216 Chipset Family Platform Controller Hub (PCH) Family Specification Update
7-series-chipset-pch-spec-update.pdf
Last update: August 2012 Revision 010
http://www.intel.com/content/www/us/en/chipsets/7-series-chipset-pch-spec-update.html?wapkw=intel+7+series+chipsets

1.3 Introduction

COM Express™, an open specification of the PICMG (PCI Industrial Computer Manufacturer Group), is a module concept to bring PCI Express and other latest technologies like SATA, USB 3.0 and different display interfaces on a COM (Computer On Module).

A COM Express™ module is plugged onto an application-specific base board similar to the ETX concept, but offers more options and a growth path to future CPU technologies. Utilizing different sizes, COM Express™ can be used for highly embedded solutions up to high performance platforms.

The design of the MSC C6B-7S module supports the 3rd Generation Intel® Core Processor Family enabling you to boost your embedded application to highest performance levels.

For evaluation and design-in of the COM Express™ modules we offer evaluation baseboards and develop motherboards providing the interface infrastructure for the COM Express™ module using PC type connectors for external access.

Currently four module sizes are defined in the COM Express Specification 2.1: the Mini Module, the Compact Module, the Basic Module and the Extended Module. The primary difference between them is the over-all physical size and the performance envelope supported by each. The Extended Module is the largest and can support larger processor and memory solutions. The Basic Module is the most common supporting typical processor platforms in the embedded world. The Compact Module is the smallest one and is intended to be used when designing with processors and chipsets in small form factor footprints (SFF).

All module sizes use the same connectors and pin-outs and utilize several common mounting hole positions. This level of compatibility allows that a carrier board designed to accommodate an Extended Module can also support a Basic or Compact Module.

Up to 440 pins of connectivity are available between COM Express™ modules and the Carrier Board. Legacy buses such as PCI, parallel ATA, LPC, HDA are supported as well as new high speed serial interconnects such as PCI Express, Serial ATA and Gigabit Ethernet.

To enhance interoperability between COM Express™ modules and Carrier Boards, seven common signaling configurations (Pin-out Types) have been defined to ease system integration.

2 Technical Description

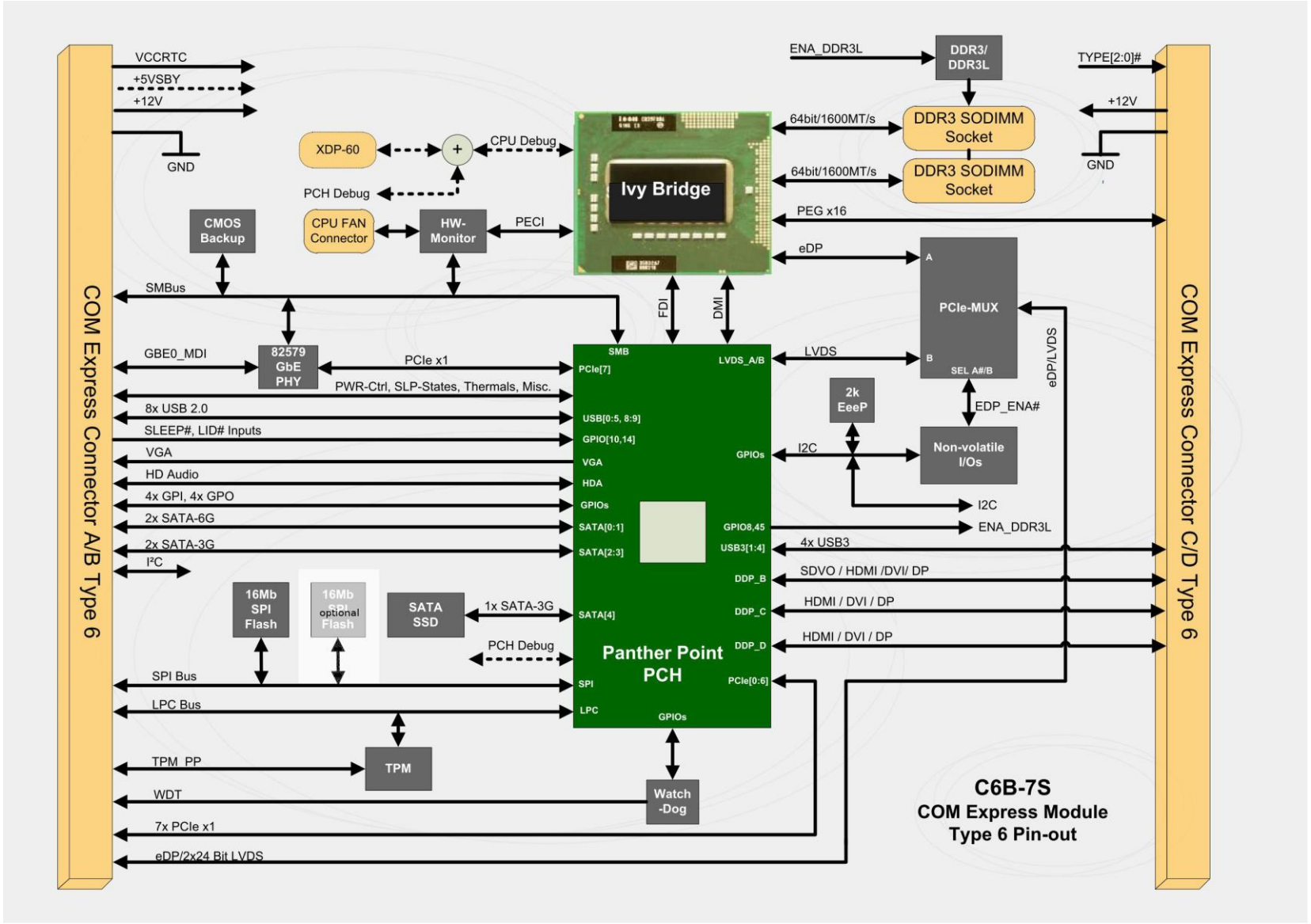
2.1 Key features

The MSC C6B-7S COM Express module is designed as a type 6 module according to COM Express® Module Base Specification Revision 2.1.

Key features include:

- Module size: 125 mm x 95 mm
- Various 3rd Generation Intel® Core Processors
- Dual 220 pin connector (440 pins)
- 2x DDR3 SO-DIMM module up to 8 GB each one
- Eight USB 2.0 ports; four can be used as USB 3.0 ports; 4 shared over-current lines
- Four Serial ATA ports; two SATA 3Gb/s and two SATA 6Gb/s
- Optional SATA NAND Flash Silicon Disk (4 GB to 32 GB)
- Seven PCI Express x1 lanes
- Support pins for two Express Cards
- Analog VGA
- Dual 24-bit LVDS channel (shared with eDP)
- Three Digital Display Interfaces (DDI) configurable as SDVO, HDMI, DVI or Display Port
- High definition digital audio interface (external CODEC)
- Single Gbit Ethernet interface (Intel 82579LM , Device ID 0x1502) with Wake On Lan support (S3,S4,S5)
- LPC interface
- Support for following Super IO : Winbond 83627
- Four GPI pins
- Four GPO pins
- +12V primary power supply input
- +5V standby (optional) and 3.3V RTC power supply inputs
- 23 PCI Express lanes (6 on A-B and 17 on C-D)
- 16 of 23 PCI Express lanes used for PCI Express Graphics
- TPM module (option, TPM 1.2, SLB9635)
- Automatic fan control
- Watchdog timer
- EAPI support

2.2 Block diagram



2.3 COM Express implementation

COM Express™ required and optional features of pin-out type 6 are summarized in the following table. The features identified as Minimum (Min.) **shall** be implemented by all modules. Features identified up to Maximum (Max) **may** be additionally implemented by a module.

The column MSC C6B-7S shows the implemented features of the MSC module.

		Type 6	MSC C6B-7S	Note
		Min / Max		
	System I/O			
A-B	PCI Express Lanes 0 - 5	1 / 6	6 (x1)	
A-B	LVDS Channels	0 / 2	2	1x dual channel, 2x24 Bit
A-B	eDP on LVDS CH A pins	0 / 1	1	
A-B	VGA Port	0 / 1	1	
A-B	TV-Out	NA	0	
A-B	DDI 0	NA	0	
A-B	Serial Ports 1- 2	0 / 2	0	
A-B	CAN interface on SER1	0 / 1	0	
A-B	SATA Ports	1 / 4	4/(1 x SSD)	2x 300MB/s (ports 2-3); 2x600MB/s (ports 0-1); optional 1 x Solid State Disk (port 4)
A-B	HDA Digital Interface	0 / 1	1	
A-B	USB 2.0 Ports	4 / 8	8	
A-B	USB Client	0 / 1	0	
A-B	USB 3.0 Ports	0 / 4	4	
A-B	LAN Port 0	1 / 1	1	Intel 82597LM GbE PHY
A-B	Express Card Support	1 / 2	2	
A-B	LPC Bus	1 / 1	1	
A-B	SPI	1 / 2	2	only one SPI flash is populated
C-D	PCI Express Lanes 16-31 (same as PEG pins)	0 / 16	1 (x16)	off-module x16 PCI Express Graphics
C-D	PCI Express Graphics (PEG)	0 / 1	1	
C-D	Muxed SDVO Channels	NA	0	
C-D	PCI Express Lanes 6-15	0 / 2	1	
C-D	PCI Bus - 32 Bit	NA	0	
C-D	PATA Port	NA	0	
C-D	LAN Ports 1-2	NA	0	
C-D	DDI 1-3	0 / 3	3	HDMI/DVI/DP
C-D	USB 3.0 Ports	0 / 4	4	
	System Management			
A-B	SDIO (muxed on GPIO)	0 / 1	0	
A-B	General Purpose Inputs	4 / 4	4	
A-B	General Purpose Outputs	4 / 4	4	
A-B	SMBus	1 / 1	1	
A-B	I^2C	1 / 1	1	
A-B	Watchdog Timer	0 / 1	1	
A-B	Speaker Out	1 / 1	1	
A-B	External BIOS ROM support	0 / 2	2	
A-B	Reset Functions	1 / 1	1	

	Power Management			
A-B	Thermal Protection	0 / 1	1	
A-B	Battery Low Alarm	0 / 1	1	
A-B	Suspend	0 / 1	1	
A-B	Wake	0 / 2	2	
A-B	Power Button Support	1 / 1	1	
A-B	Power Good	1 / 1	1	
A-B	VCC_5V_SBY Contacts	4 / 4	4	
A-B	Sleep Input	0 / 1	1	
A-B	Lid Input	0 / 1	1	
A-B	Fan Control Signals	0 / 2	2	
A-B	Trusted Platform Modules	0 / 1	1	optional TPM 1.2 module

2.4 Functional units

CPUs (FCBGA-1023)	Intel® Core™ i7-3615QE (Quad Core, 2.3GHz, 6MB, 45W). Intel® Core™ i7-3612QE (Quad Core, 2.1GHz, 6MB, 45W). Intel® Core™ i7-3555LE (Dual Core, 2.5GHz, 4MB, LV 25W). Intel® Core™ i7-3517UE (Dual Core, 1.7GHz, 4MB, ULV 17W). Intel® Core™ i5-3610ME (Dual Core, 2.7GHz, 4MB, SV 35W). Intel® Core™ i3-3120ME (Dual Core, 2.4GHz, 4MB, SV 35W). Intel® Core™ i3-3217UE (Dual Core, 1.6GHz, 3MB, ULV 25W). Intel® Celeron® 847E (Dual Core, 1.1GHz, 2MB, ULV 17W). Intel® Celeron® 827E (Single Core, 1.4GHz, 1.5MB, ULV 17W).
Chipset	Intel® 82QM77 with Intel® Core™ i5 and Intel® Core™ i7 processor SKUs. Intel® 82HM76 with Intel® Core™ i3 and Intel® Celeron® processor SKUs.
Memory	Two 204-pin DDR3 SO-DIMM sockets for up to 16GB non-ECC unbuffered DDR3. Maximal height 1250mil = 31.75mm. PC3-8500 DDR3 SDRAM (DDR3-1066). PC3-10600 DDR3 SDRAM (DDR3-1333). PC3-12800 DDR3 SDRAM (DDR3-1600), not supported with all processors.
SATA	4 SATA channels, port 0-1 up to 600MB/s, port 2-3 up to 300MB/s.
USB	8 x USB 2.0. 4 x USB 3.0.
COM Express™	Type 6 interface, fully compliant to COM Express Base Specification R2.1.
PCI Express™	Seven channels PCIe x1.
LPC	Low Pin Count Bus for heritage interfaces.
SPI	Serial Peripheral Interface for up to two SPI flash devices.
Graphics Controller	Intel HD Graphics 2000/3000 depending on processor SKU.
Video Memory	Intel® Dynamic Video Memory Technology (Intel® DVMT 5.0)
LVDS	Dual channel 24-bit LVDS (1.600 x 1.200 @ 60 Hz).
Digital Display Ports	DDPort B configurable as HDMI/DVI (1920 x 1200 @ 60 Hz), DP (2560 x 1600 @ 60 Hz) and SDVO (200 MP/s). DDPort C configurable as HDMI/DVI (1920 x 1200 @ 60 Hz) and DP (2560 x 1600 @ 60 Hz). DDPort D configurable as HDMI/DVI (1920 x 1200 @ 60 Hz), DP (2560 x 1600 @ 60 Hz) and eDP.
PEG	PCIe x16 graphics port (PEG) supports external graphics cards (not available on Intel® Celeron® 807UE processor).
CRT Interface	340.4 MHz RAMDAC (2.048 x 1.536 @ 75 Hz).
Ethernet	10/100/1000Base-TX (Intel® 82579LM, Device ID 0x1502) with WOL support (S3,S4,S5)
Sound Interface	Intel® High Definition Audio Interface. Support for up to three external codecs. Integrated DisplayPort/HDMI Audio support.
Watchdog Timer	PIC12C509A creates system reset (programmable timeout, 1s … 255h).
TPM (option)	Optional TPM module, TPM 1.2, SLB9635.
Fan Supply	4-pin header for support of a 12V PWM fan.
Real Time Clock	RTC integrated in PCH.
CMOS Battery	External.

System Monitoring	Voltages, temperatures, fan ▪ Core voltage ▪ 3.3V onboard voltage ▪ 12V input voltage ▪ 5V SBY input voltage ▪ CPU temperature (0°C - 100°C) ▪ System memory temperature ▪ Board temperature ▪ Fan speed and automatic fan speed control

2.5 Power Supply

- **+12V primary power supply input**
- **+5V standby**
  Option, is not required for module operation.
  If not present, customer has to make sure that the supply voltages which are generated on the carrier board are switched off during suspend states, so that no current from the carrier board's signal lines can flow to the CPU board.
- **3.3V RTC power supply**
  Option, is not required for module operation.
  BIOS SETUP data is stored in a non volatile backup memory device, therefore configuration data will not get lost during power off (except for time and date information)

Voltage	Input range	Power Consumption
+12V	+11.4V - 12.6 V	Refer to chapter 2.6
+5V Standby	+4.75V - 5.25 V	
+3V RTC power supply	+2.0V - 3.3V	Typ. 1.8 µA

2.6 Power Dissipation

2.6.1 Running Mode

All measurements were made by plugging the MSC C6B-7S module onto a MSC C6-MB-EVA evaluation board. The module was equipped with two 4GByte memory modules NANYA NT4GC64B8HB0NS-CG 1112.CN, 4GB 2Rx8 PC3-10600S-9-10-F2.1333. The table below shows typical values which refer to consumption of the module itself without consumption of the base board and CPU fan.

The following applications have been tested.

1. DOS prompt.
2. Windows desktop (idle) under Microsoft Windows 7 Professional 64-bit SP1.
3. Running Intel® Thermal Analysis Tool (TAT!) Ver. 4.x to achieve 70% CPU workload on each processor core/thread and 100% Graphics workload as recommended by Intel under Microsoft Windows 7 Professional 64-bit SP1.

Module / CPU	DOS	Win 7 Idle	Win 7 TAT!	
			long term	max. [1]
MSC C6B-7S-005 Intel® Core™ i5-3610ME (35W)	13 W	8 W	43 W	45 W
MSC C6B-7S-003 Intel® Core™ i3-3217UE (17W)	10 W	8 W	29 W	- [2]
MSC C6B-7S-202 Intel® Celeron® 847E (17W)	12 W	8 W	23 W	- [2]
MSC C6B-7S-209 Intel® Celeron® 827E (17W)	12 W	8 W	21 W	- [2]

1) Due to the Intel® Turbo Boost Technology 2.0 feature on 2nd Generation Intel® Core™ i5 and 2nd / 3rd/Generation Intel® Core™ i7 processors the maximum power consumption for short durations may be higher than the long term power consumption. The power supply must be able to deliver this additional amount of power.

2) The Intel® Turbo Boost Technology 2.0 feature is not available on 2nd/ 3rd/Generation Intel® Core™ i3 and Intel® Celeron® processors.

2.6.2 Power Dissipation (Standby Modes)

1. System is shut down into “Soft Off” (S5) or “Suspend to Disk” (S4) by Windows 7 Professional 64-bit SP1.
2. System is shut down into “Soft Off” (S5) or “Suspend to Disk” (S4) by Windows 7 Professional 64-bit SP1 with Wake On LAN enabled.
3. System is shut down into “Suspend to RAM” (S3) by Windows 7 Professional 64-bit SP1.
4. System is shut down into “Suspend to RAM” (S3) by Windows 7 Professional 64-bit SP1 with Wake On LAN enabled.

Module / CPU	Input Power	S3		S4 / S5	
		no WOL	WOL enabled	no WOL	WOL enabled
MSC C6B-7S-005 Intel® Core™ i5-3610ME	12V/5V_SBY	0.9 W	1.0 W	0.4 W	0.5 W
	12V only	1.5 W	1.5 W	0.8 W	0.8 W
MSC C6B-7S-003 Intel® Core™ i3-3217UE	12V/5V_SBY	1.1 W	1.1 W	0.6 W	0.6 W
	12V only	1.9 W	1.9 W	1.2 W	1.2 W
MSC C6B-7S-202 Intel® Celeron® 847E	12V/5V_SBY	0.8 W	0.9 W	0.3 W	0.4 W
	12V only	1.1 W	1.2 W	0.3 W	0.4 W
MSC C6B-7S-209 Intel® Celeron® 827E	12V/5V_SBY	1.0 W	1.0 W	0.6 W	0.6 W
	12V only	1.7 W	1.7 W	1.0 W	1.0 W

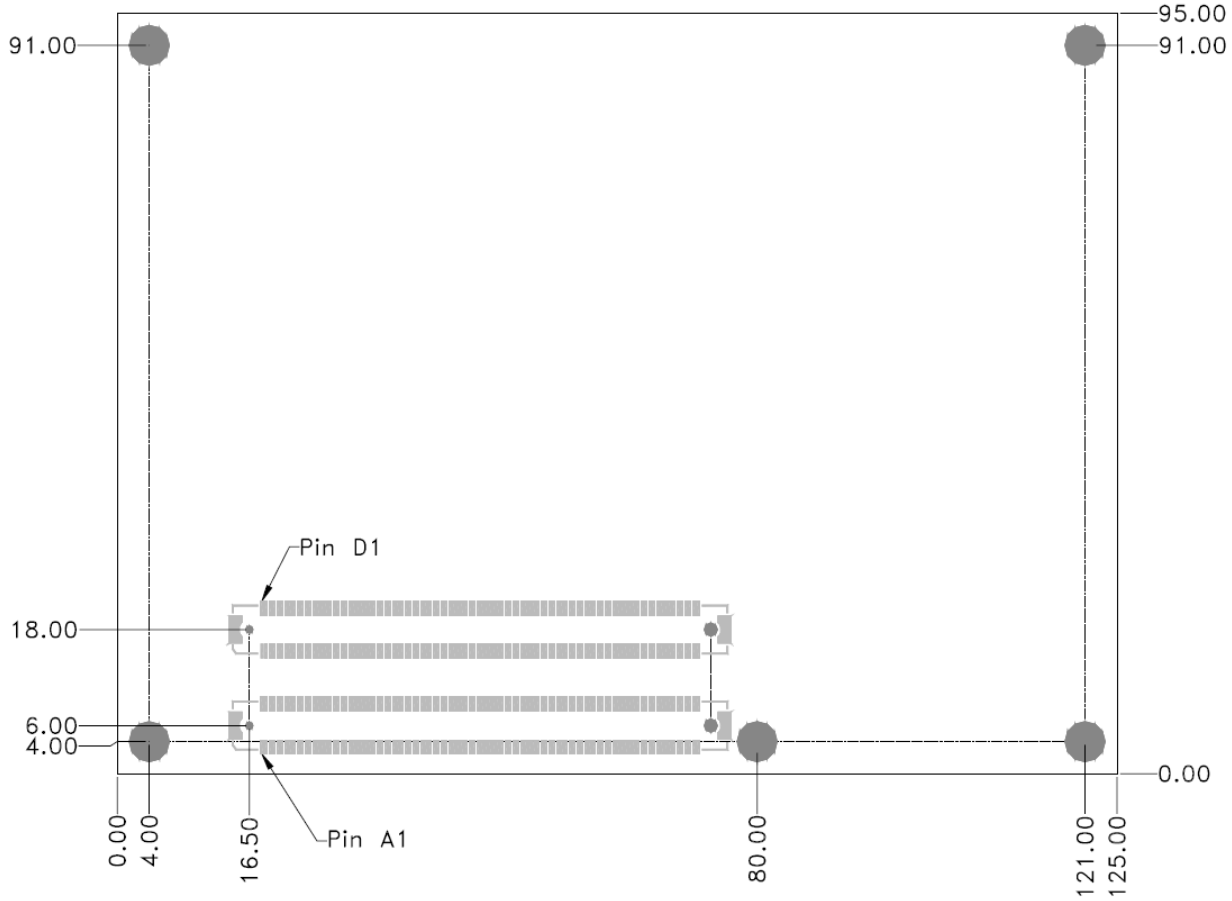
2.7 System Memory

The MSC C6B-7S CPU module provides two sockets for memory modules which have to meet the following demands:

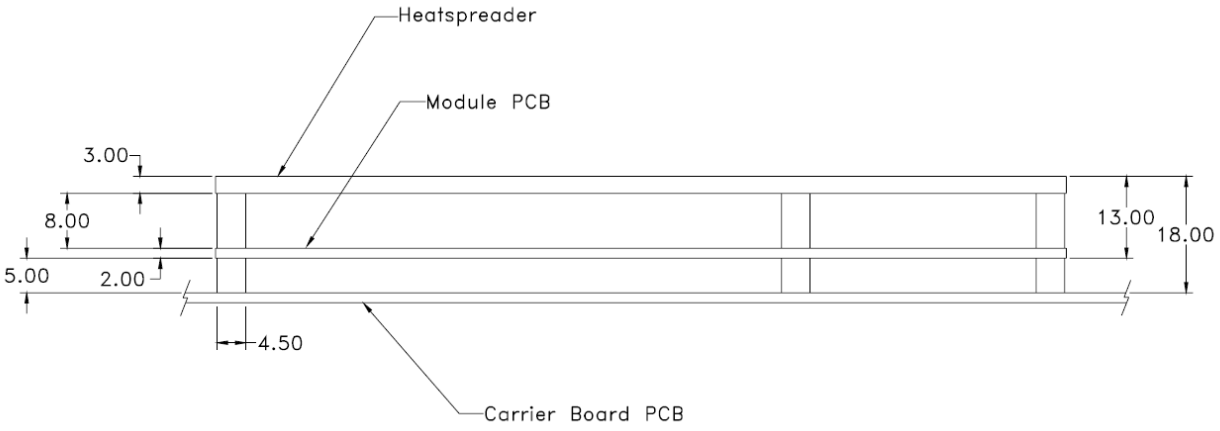
- 204pin unbuffered non-ECC DDR3 SO-DIMM, Raw Card A, B, C and F.
- 1.5V Supply Voltage
- DDR3-1066 / PC3-8500, DDR3-1333 / PC3-10600
- DDR3-1600 / PC3-12800 with Core i7-3615QE, Core i7-3612QE, Core i7-3555LE, Core i7-3517UE, Core i5-3610ME, Core i3-3217UE, Core i7-2715QE.
- Maximum module height: 30mm.
- SPD (Serial Presence Detect) EEPROM.

2.8 Mechanical Dimensions

2.8.1 Compact module



There are two height options defined in the COM Express specification: 5mm and 8mm. The height option is defined by the connectors on the baseboard.



2.9 Thermal specifications

The cooling solution of a COM Express module is based on a heat-spreader concept.

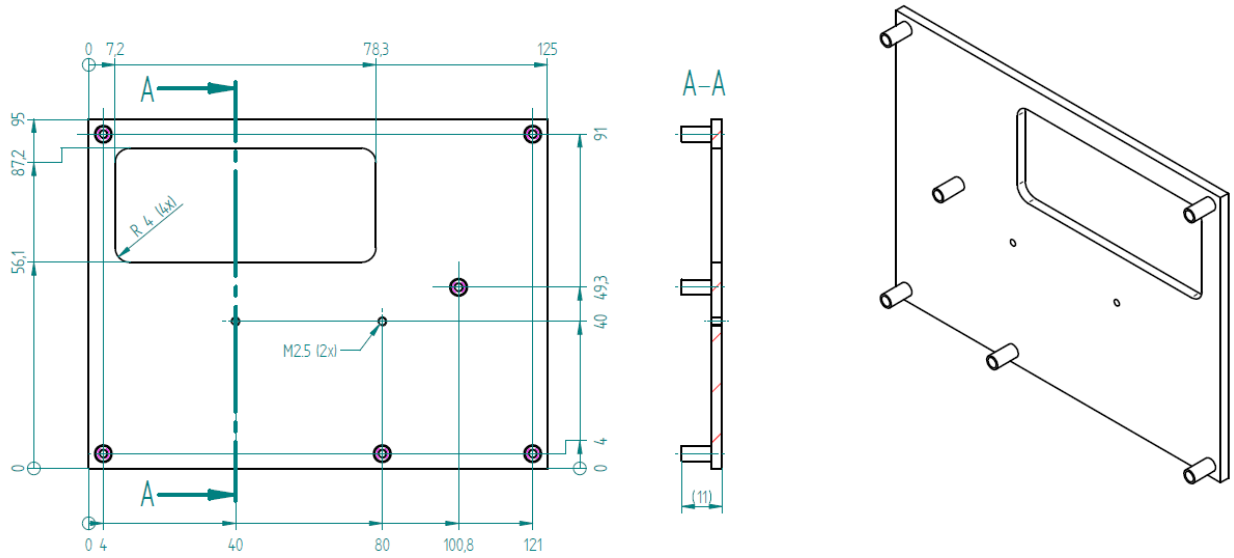
A heat-spreader is a metal plate (typically aluminium) mounted on the top of the module. The connection between this plate and the module components is typically done by thermal interface materials like phase change foils, gap pads and copper or aluminium blocks. A very good thermal conductivity is required in order to conduct the heat from the CPU and the chipset to the heat-spreader plate.

The heat-spreader of the MSC module is thermally attached using phase change materials and small aluminium blocks filling the gap between CPU and chipset dies and the heat-spreader plate.

The heat-spreader is not a heat-sink! It is a defined thermal interface for the system designer with fixed mechanical dimensions, so it should be possible to change different module types without problems. There must be a cooling solution for the system. The surface temperature of the heat-spreader should not exceed 80°C.

Main issue for the thermal functionality of a system is that each device of the module is operated within its specified thermal values. The max value for the CPU is 100°C and 108°C for the chipset. So there may be system implementations where the heat-spreader temperature could be higher.

Anyway, in this case it has to be validated that there are no thermal specification violations of any assembled part or integrated circuit over the system temperature range even at worst case conditions.



Additionally MSC offers adequate heat-sink solutions for the different C6B-7S modules depending on the power dissipation of the implemented CPU. For more information please refer to www.msc-technologies.eu or contact your sales representative.

2.10 Signal description

Pins are marked in the following tables with the power rail associated with the pin, and, for input and I/O pins, with the input voltage tolerance. The pin power rail and the pin input voltage tolerance **may** be different. For example, the PCI group is defined as having a 3.3V power rail, meaning that the output signals will only be driven to 3.3V, but the pins are tolerant of 5V signals.

An additional label, “Sus”, indicates that the pin is active during suspend states (S3,S4,S5). If suspend modes are used, then care must be taken to avoid loading signals that are active during suspend to avoid excessive suspend mode current draw.

I = Input.

O = Output.

OD = Open Drain output.

I/OD = Bi-directional Input/Open Drain Output Pin.

I/O = Bi-directional Input/Output.

ePU = external pull-up resistor on COM Express module.

ePD = external pull-down resistor on COM Express module.

eSR = external series resistor on COM Express module.

iPU = integrated pull-up resistor inside PCH or other IC, real value may vary from nominal one.

iPD = integrated pull-down resistor inside PCH or other IC, real value may vary from nominal one.

2.10.1 High Definition Audio

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
HDA_RST#	O	CMOS	3.3V Sus		eSR = 33 Ω	Reset output to CODEC, active low.	PCH 82QM77/HM76
HDA_SYNC	O	CMOS	3.3V Sus		ePU =1 KΩ iPD = 20 KΩ eSR = 33 Ω	48kHz fixed-rate, sample-synchronization signal to the CODEC(s), functional strap option sampled with rising edge of RSMRST#, iPD is disabled after RSMRST# de-assertion.	PCH 82QM77/HM76
HDA_BITCLK	O	CMOS	3.3V Sus		eSR = 33 Ω	24.00 MHz serial data clock generated by the PCH	PCH 82QM77/HM76
HDA_SDOUT	O	CMOS	3.3V Sus		iPD = 20 KΩ eSR = 33 Ω	Serial TDM data output to the CODEC, functional strap option, iPD is disabled after PLTRST# de-assertion.	PCH 82QM77/HM76
HDA_SDIN[0:2]	I	CMOS	3.3V Sus	3.3V	iPD = 20 KΩ eSR = 33 Ω	Serial TDM data inputs from up to 3 CODECs.	PCH 82QM77/HM76

2.10.2 Ethernet

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
GBE0_MDI[0:3]+ GBE0_MDI[0:3]-	I/O	Analog	3.3V Sus	3.3V		Gigabit Ethernet Controller 0: Media Dependent Interface Differential Pairs 0,1,2,3. The MDI can operate in 1000, 100 and 10 Mbit / sec modes. MDI[0]+/- B1_DA+/- MDI[1]+/- B1_DB+/- MDI[2]+/- B1_DC+/- MDI[3]+/- B1_DD+/-	82579LM
GBE0_ACT#	OD	CMOS	3.3V Sus	5V / 20 mA		Gigabit Ethernet Controller 0 activity indicator, active low.	82579LM
GBE0_LINK#	OD	CMOS	3.3V Sus	5V / 20 mA		Gigabit Ethernet Controller 0 link indicator, active low.	82579LM
GBE0_LINK100#	OD	CMOS	3.3V Sus	5V / 20 mA		Gigabit Ethernet Controller 0 100 Mbit / sec link indicator, active low.	82579LM
GBE0_LINK1000#	OD	CMOS	3.3V Sus	5V / 20 mA		Gigabit Ethernet Controller 0 1000 Mbit / sec link indicator, active low.	82579LM
GBE0_CTREF	REF					N/A. Center tab voltage not needed by 82759LM.	

2.10.3 Serial ATA

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
SATA0_TX+ SATA0_TX-	O	SATA	3.3V	AC coupled on module		Serial ATA Channel 0 transmit differential pair.	PCH 82QM77/HM76
SATA0_RX+ SATA0_RX-	I	SATA	3.3V	AC coupled on module		Serial ATA Channel 0 receive differential pair.	PCH 82QM77/HM76
SATA1_TX+ SATA1_TX-	O	SATA	3.3V	AC coupled on module		Serial ATA Channel 1transmit differential pair.	PCH 82QM77/HM76
SATA1_RX+ SATA1_RX-	I	SATA	3.3V	AC coupled on module		Serial ATA Channel 1 receive differential pair.	PCH 82QM77/HM76
SATA2_TX+ SATA2_TX-	O	SATA	3.3V	AC coupled on module		Serial ATA Channel 2 transmit differential pair.	PCH 82QM77/HM76
SATA2_RX+ SATA2_RX-	I	SATA	3.3V	AC coupled on module		Serial ATA Channel 2 receive differential pair.	PCH 82QM77/HM76
SATA3_TX+ SATA3_TX-	O	SATA	3.3V	AC coupled on module		Serial ATA Channel 3 transmit differential pair.	PCH 82QM77/HM76
SATA3_RX+ SATA3_RX-	I	SATA	3.3V	AC coupled on module		Serial ATA Channel 3 receive differential pair.	PCH 82QM77/HM76

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
ATA_ACT#	OD	CMOS	3.3V	5V /20 mA		SATA activity indicator, active low.	PCH 82QM77/HM76

2.10.4 PCI Express Lanes

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
PCIE_TX[0:6+ PCIE_TX[0:6]-	O	PCIe	3.3V	AC coupled on module		PCI Express Differential Transmit Pairs 0 through 6	PCH 82QM77/HM76
PCIE_RX[0:6]+ PCIE_RX[0:6]-	I	PCIe	3.3V	AC coupled off module		PCI Express Differential Receive Pairs 0 through 6	PCH 82QM77/HM76
PCIE_CLK_REF+ PCIE_CLK_REF-	O	PCIe CLK	3.3V			Differential Reference Clock output for all PCI Express and PCI Express Graphics lanes.	PCH 82QM77/HM76

Note: PCIe lanes #7 is used on the C6B-7S module and therefore not available for externally.

2.10.5 PCI Express x16Graphic Lanes

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
PEG_TX[0:15]+ PEG_TX[0:15]-	O	PCIe	3.3V	AC coupled on module		PCI Express Graphics transmit differential pairs. These signals can also be used as standard PCI Express transmit lanes as PCIE_TX[16:31]+/-	CPU
PEG_RX[0:15]+ PEG_RX[0:15]-	I	PCIe	3.3V	AC coupled off module		PCI Express Graphics receive differential pairs. These signals can also be used as standard PCI Express receive lanes as PCIE_RX[16:31]+/-	CPU
PEG_LANE_RV#	I	CMOS	3.3V	3.3V	ePU = 5.7 KΩ	PCI Express Graphics lane reversal input strap. Pull low on the carrier board to reverse lane order.	CPU

2.10.6 Express Card Support

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD	Description	Source / Target
EXCD[0]_CPPE#	I	CMOS	3.3V	3.3V	ePU = 10 KΩ	ExpressCard card request, active low	PCH 82QM77/HM76
EXCD[1]_CPPE#	I	CMOS	3.3V	3.3V	ePU = 10 KΩ	ExpressCard card request, active low	PCH 82QM77/HM76

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD	Description	Source / Target
EXCD[0]_RST#	O	CMOS	3.3V	3.3V	ePU = 8.2 KΩ	ExpressCard reset, active low	PCH 82QM77/HM76
EXCD[1]_RST#	O	CMOS	3.3V	3.3V	ePU = 8.2 KΩ	ExpressCard reset, active low	PCH 82QM77/HM76

2.10.7 USB

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
USB[0:7]+ USB[0:7]-	I/O	USB	3.3V Sus	3.3V		USB differential pairs, channels 0 through 7	PCH 82QM77/HM76
USB_0_1_OC#	I	CMOS	3.3V Sus	3.3V	ePU = 8.2 KΩ	USB channels 0 and 1 over-current sense. A pull-up for this line is present on the module. An open drain driver from a USB current monitor on the Carrier Board may drive this line low. Do not pull this line high on the Carrier Board.	PCH 82QM77/HM76
USB_2_3_OC#	I	CMOS	3.3V Sus	3.3V	ePU = 8.2 KΩ	USB channels 2 and 3 over-current sense. A pull-up for this line is present on the module. An open drain driver from a USB current monitor on the Carrier Board may drive this line low. Do not pull this line high on the Carrier Board.	PCH 82QM77/HM76
USB_4_5_OC#	I	CMOS	3.3V Sus	3.3V	ePU = 8.2 KΩ	USB channels 4 and 5 over-current sense. A pull-up for this line is present on the module. An open drain driver from a USB current monitor on the Carrier Board may drive this line low. Do not pull this line high on the Carrier Board.	PCH 82QM77/HM76
USB_6_7_OC#	I	CMOS	3.3V Sus	3.3V	ePU = 8.2 KΩ	USB channels 6 and 7 over-current sense. A pull-up for this line is present on the module. An open drain driver from a USB current monitor on the Carrier Board may drive this line low. Do not pull this line high on the Carrier Board.	PCH 82QM77/HM76
USB_SSTX[0:3]+ USB_SSTX[0:3]-	I/O	USB 3.0	3.3V	AC coupled on module		USB 3.0 Differential Transmit Pairs 0 through 4	PCH 82QM77/HM76
USB_SSRX[0:3]+ USB_SSRX[0:3]-	I/O	USB 3.0	3.3V	AC coupled off module		USB 3.0 Differential Receive Pairs 0 through 4	PCH 82QM77/HM76

2.10.8 LPC Bus

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
LPC_AD[0:3]	I/O	CMOS	3.3V	3.3V	iPU = 20 KΩ	LPC multiplexed address, command and data bus	PCH 82QM77/HM76
LPC_FRAME#	O	CMOS	3.3V			LPC frame indicates the start of an LPC cycle	PCH 82QM77/HM76
LPC_DRQ[0:1]#	I	CMOS	3.3V	3.3V	iPU = 20 KΩ	LPC serial DMA request	PCH 82QM77/HM76
LPC_SERIRQ	I/OD	CMOS	3.3V	3.3V	ePU = 200 Ω	LPC serial interrupt	PCH 82QM77/HM76
LPC_CLK	O	CMOS	3.3V		eSR = 22 Ω	LPC clock output - 33MHz nominal	PCH 82QM77/HM76

2.10.9 LVDS Flat Panel

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
LVDS_A[0:3]+ LVDS_A[0:3]-	O	LVDS				LVDS Channel A differential pairs	PCH 82QM77/HM76
LVDS_A_CK+ LVDS_A_CK-	O	LVDS				LVDS Channel A differential clock	PCH 82QM77/HM76
LVDS_B[0:3]+ LVDS_B[0:3]-	O	LVDS				LVDS Channel B differential pairs	PCH 82QM77/HM76
LVDS_B_CK+ LVDS_B_CK-	O	LVDS				LVDS Channel B differential clock	PCH 82QM77/HM76
LVDS_VDD_EN	O	CMOS	3.3V		ePD = 100 KΩ	LVDS panel power enable	PCH 82QM77/HM76
LVDS_BKLT_EN	O	CMOS	3.3V		ePD = 100 KΩ	LVDS panel backlight enable	PCH 82QM77/HM76
LVDS_BKLT_CTRL	O	CMOS	3.3V			LVDS panel backlight brightness control	PCH 82QM77/HM76
LVDS_I2C_CK	O	CMOS	3.3V		ePU = 2.2 KΩ	I2C clock output for LVDS display use	PCH 82QM77/HM76
LVDS_I2C_DAT	I/OD	CMOS	3.3V	3.3V	ePU = 2.2 KΩ	I2C data line for LVDS display use	PCH 82QM77/HM76

2.10.10 Analog VGA

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
VGA_RED	O	Analog			ePD = 150 Ω	Red for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load.	PCH 82QM77/HM76
VGA_GRN	O	Analog			ePD = 150 Ω	Green for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load.	PCH 82QM77/HM76
VGA_BLU	O	Analog			ePD = 150 Ω	Blue for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load.	PCH 82QM77/HM76
VGA_HSYNC	O	CMOS	3.3V			Horizontal sync output to VGA monitor	PCH 82QM77/HM76
VGA_VSYNC	O	CMOS	3.3V			Vertical sync output to VGA monitor	PCH 82QM77/HM76
VGA_I2C_CK	O	CMOS	3.3V		ePU = 2.2 KΩ	DDC clock line. I^2C port dedicated to identify VGA monitor capabilities	PCH 82QM77/HM76
VGA_I2C_DAT	I/OD	CMOS	3.3V	3.3V	ePU = 2.2 KΩ	DDC data line. I^2C port dedicated to identify VGA monitor capabilities	PCH 82QM77/HM76

2.10.11 Digital Display Interfaces

2.10.11.1 Overview Type6 DDI Video Type Mapping

	Signal	SDVO	DP	HDMI/DVI (TMDS Signaling)
DDI1	DDI1_PAIR0+/-	SDVO1_RED+/-	DP1_LANE0+/-	TMDS1_DATA2+/-
	DDI1_PAIR1+/-	SDVO1_GRN+/-	DP1_LANE1+/-	TMDS1_DATA1+/-
	DDI1_PAIR2+/-	SDVO1_BLU+/-	DP1_LANE2+/-	TMDS1_DATA0+/-
	DDI1_PAIR3+/-	SDVO1_RED+/-	DP1_LANE3+/-	TMDS1_DATACLK+/-
	DDI1_PAIR4+/-	SDVO1_CK+/-		
	DDI1_PAIR5+/-	SDVO1_TVCLKIN+/-		
	DDI1_PAIR6+/-	SDVO1_FLDSTALL+/-		
	DDI1_HPD		DP1_HPD	HDMI1_HPD
	DDI1_CTRLCLK/DATA_AUX+/-	SDVO1_CTRLCLK/DATA	DP1_AUX+/-	HDMI1_CTRLCLK/DATA
	DDI1_DDC_AUX_SEL			
DDI2	DDI2_PAIR0+/-		DP2_LANE0+/-	TMDS2_DATA2+/-
	DDI2_PAIR1+/-		DP2_LANE1+/-	TMDS2_DATA1+/-
	DDI2_PAIR2+/-		DP2_LANE2+/-	TMDS2_DATA0+/-
	DDI2_PAIR3+/-		DP2_LANE3+/-	TMDS2_DATACLK+/-

	Signal	SDVO	DP	HDMI/DVI (TMDS Signaling)
	DDI2_HPD		DP2_HPD	HDMI2_HPD
	DDI2_CTRLCLK/DATA_AUX+/-		DP2_AUX+/-	HDMI2_CTRLCLK/DATA
	DDI2_DDC_AUX_SEL			
DDI3	DDI3_PAIR0+/-		DP3_LANE0+/-	TMDS3_DATA2+/-
	DDI3_PAIR1+/-		DP3_LANE1+/-	TMDS3_DATA1+/-
	DDI3_PAIR2+/-		DP3_LANE2+/-	TMDS3_DATA0+/-
	DDI3_PAIR3+/-		DP3_LANE3+/-	TMDS3_DATACLK+/-
	DDI3_HPD		DP3_HPD	HDMI3_HPD
	DDI3_CTRLCLK/DATA_AUX+/-		DP3_AUX+/-	HDMI3_CTRLCLK/DATA
	DDI3_DDC_AUX_SEL			

2.10.11.2 SVDO (Digital Display Port 1 only)

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
SDVO1_RED+ SDVO1_RED-	O	PCIe		AC coupled off module		Serial Digital Video red output differential pair	PCH 82QM77/HM76
SDVO1_GRN+ SDVO1_GRN-	O	PCIe		AC coupled off module		Serial Digital Video green output differential pair	PCH 82QM77/HM76
SDVO1_BLU+ SDVO1_BLU-	O	PCIe		AC coupled off module		Serial Digital Video blue output differential pair	PCH 82QM77/HM76
SDVO1_CK+ SDVO1_CK-	O	PCIe		AC coupled off module		Serial Digital Video clock output differential pair.	PCH 82QM77/HM76
SDVO1_TVCLKIN+ SDVO1_TVCLKIN-	I	PCIe		AC coupled off module		Serial Digital Video TVOUT synchronization clock input differential pair.	PCH 82QM77/HM76
SDVO1_INT+ SDVO1_INT-	I	PCIe		AC coupled off module		Serial Digital Video Interrupt input differential pair.	PCH 82QM77/HM76

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
SDVO1_FLDSTALL+ SDVO1_FLDSTALL	I	PCIe		AC coupled off module		Serial Digital Video Field Stall input differential pair.	PCH 82QM77/HM76
SDVO1_CTRLDATA	I/O	CMOS	3.3V	3.3V	ePU = 100kΩ	SDVO Control Data. Shared with port HDMI/DVI	PCH 82QM77/HM76
SDVO1_CTRLCLK	I/O	CMOS	3.3V	3.3V	ePD = 100kΩ	SDVO Control Clock. Shared with port HDMI/DVI	PCH 82QM77/HM76
DDI1_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Pull to 3.3V on the Carrier with 100k Ohm resistor to configure the DDI1_AUX pair as the DDC channel.	

Note: For DDI1 the default configuration with BIOS Version V1.01 is SDVO.
In order to implement Display Port on DDI1 a modified BIOS version is necessary.
Please contact MSC Technical Support if this is required

2.10.11.3 DisplayPort

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
DP1_LANE[0:3]+ DP1_LANE[0:3]-	O			AC coupled off module		DisplayPort Lane [0:3] differential pairs.	PCH 82QM77/HM76
DP1_AUX+ DP1_AUX-	I/O			AC coupled off module	ePD = 100kΩ ePU = 100kΩ	DisplayPort Aux control channel differential pair	PCH 82QM77/HM76
DP1_HPD	I	CMOS	3.3V	3.3V		DisplayPort Hot Plug Detect.	PCH 82QM77/HM76
DDI1_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Connect to pin 13 of the DisplayPort connector to enable Dual-Mode DisplayPort interface (DP++).	
DP2_LANE[0:3]+ DP2_LANE[0:3]-	O			AC coupled off module		DisplayPort Lane [0:3] differential pairs.	PCH 82QM77/HM76
DP2_AUX+ DP2_AUX-	I/O			AC coupled off module	ePD = 100kΩ ePU = 100kΩ	DisplayPort Aux control channel differential pair	PCH 82QM77/HM76
DP2_HPD	I	CMOS	3.3V	3.3V		DisplayPort Hot Plug Detect.	PCH 82QM77/HM76
DDI2_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Connect to pin 13 of the DisplayPort connector to enable Dual-Mode DisplayPort interface (DP++).	

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
DP3_LANE[0:3]+ DP3_LANE[0:3]-	O			AC coupled off module		DisplayPort Lane [0:3] differential pairs.	PCH 82QM77/HM76
DP3_AUX+ DP3_AUX-	I/O			AC coupled off module	ePD = 100kΩ ePU = 100kΩ	DisplayPort Aux control channel differential pair	PCH 82QM77/HM76
DP3_HPD	I	CMOS	3.3V	3.3V		DisplayPort Hot Plug Detect.	PCH 82QM77/HM76
DDI3_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Connect to pin 13 of the DisplayPort connector to enable Dual-Mode DisplayPort interface (DP++).	

Note: For DDI1 the default configuration with BIOS Version V1.01 is SDVO.
In order to implement Display Port on DDI1 a modified BIOS version is necessary.
Please contact MSC Technical Support if this is required

2.10.11.4 HDMI / DVI

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
TMDS1_DATA[0:3]+ TMDS1_DATA[0:3]-	O	TMDS		AC coupled off module		HDMI/DVI TMDS Data [0:3] output differential pairs.	PCH 82QM77/HM76
TMDS1_DATACLK+ TMDS1_DATACLK-	O	TMDS		AC coupled off module		HDMI/DVI TMDS Clock differential pairs.	PCH 82QM77/HM76
TMDS1_CTRLCLK	I/O	CMOS	3.3V	3.3V	ePU = 2.2kΩ	HDMI/DVI Control Clock. Shared with SDVO_CTRLCLK	PCH 82QM77/HM76
TMDS1_CTRLDATA	I/O	CMOS	3.3V	3.3V	ePU = 2.2kΩ	HDMI/DVI Control Data. Shared with SDVO_CTRLDATA	PCH 82QM77/HM76
TMDS1_HPD	I	CMOS	3.3V	3.3V		HDMI/DVI Hot Plug Detect.	PCH 82QM77/HM76
DDI1_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Pull to 3.3V on the Carrier with 100k Ohm resistor to configure the DDI1_AUX pair as the DDC channel.	
TMDS2_D[0:3]+ TMDS2_D[0:3]-	O	TMDS		AC coupled off module		HDMI/DVI Data [0:3] output differential pairs.	PCH 82QM77/HM76
TMDS2_DATACLK+ TMDS2_DATACLK-	O	TMDS		AC coupled off module		HDMI/DVI TMDS Clock differential pairs.	PCH 82QM77/HM76
TMDS2_CTRLCLK	I/O	CMOS	3.3V	3.3V	ePU = 2.2kΩ	HDMI/DVI Control Clock.	PCH 82QM77/HM76

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
TMDS2_CTRLDATA	I/O	CMOS	3.3V	3.3V	ePU = 2.2kΩ	HDMI/DVI Control Data.	PCH 82QM77/HM76
TMDS2_HPD	I	CMOS	3.3V	3.3V		HDMI/DVI Hot Plug Detect.	PCH 82QM77/HM76
DDI2_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Pull to 3.3V on the Carrier with 100k Ohm resistor to configure the DDI1_AUX pair as the DDC channel.	
TMDS3_D[0:3]+ TMDS3_D[0:3]-	O	TMDS		AC coupled off module		HDMI/DVI Data [0:3] output differential pairs.	PCH 82QM77/HM76
TMDS3_DATACLK+ TMDS3_DATACLK-	O	TMDS		AC coupled off module		HDMI/DVI TMDS Clock differential pairs.	PCH 82QM77/HM76
TMDS3_CTRLCLK	I/O	CMOS	3.3V	3.3V	ePU = 2.2kΩ	HDMI/DVI Control Clock.	PCH 82QM77/HM76
TMDS3_CTRLDATA	I/O	CMOS	3.3V	3.3V	ePU = 2.2kΩ	HDMI/DVI Control Data.	PCH 82QM77/HM76
TMDS3 _HPD	I	CMOS	3.3V	3.3V		HDMI/DVI Hot Plug Detect.	PCH 82QM77/HM76
DDI3_DDC_AUX_SEL	I	CMOS	3.3V	3.3V	ePD = 1MΩ	Pull to 3.3V on the Carrier with 100k Ohm resistor to configure the DDI1_AUX pair as the DDC channel.	

2.10.12 Miscellaneous

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
I2C_CK	I/O OD	CMOS	3.3V (3.3V Sus)		ePU = 2.2 KΩ	General purpose I2C port clock output	PCH 82QM77/HM76 GPIO47
I2C_DAT	I/O OD	CMOS	3.3V (3.3V Sus)	3.3V	ePU = 2.2 KΩ	General purpose I2C port data I/O line	PCH 82QM77/HM76 GPIO56
SPKR	O	CMOS	3.3V			Output for audio enunciator - the "speaker" in PC-AT systems	PCH 82QM77/HM76
BIOS_DIS[1:0]#	I	CMOS	3.3V		ePU = 5 KΩ	Module BIOS disable inputs [1:0]#	PCH 82QM77/HM76
WDT	O	CMOS	3.3V		ePD = 10 KΩ	Active high output indicating that a watchdog time-out has occurred.	PIC12F509
FAN_PWMOUT	O	CMOS	3.3V	12V	ePU = 10 KΩ	Fan speed control. Uses the Pulse Width Modulation (PWM) technique to control the fan's RPM.	ADT7490

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
FAN_TACHIN	I OD	CMOS	3.3V	12V	ePU = 10 KΩ	Fan tachometer input for a fan with a two pulse output.	ADT7490
TPM_PP	I	CMOS	3.3V	3.3V	iPD	Trusted Platform Module (TPM) Physical Presence pin. Active high.	TPM

Note: COM Express Specification R2.1 redefines the I2C bus to be in the suspend plane 3.3V_SUS rather than in the 3.3V plane.

To avoid leakage current into carrier boards that were designed upon earlier COM Express specifications the MSC C6B-7S modules hold these pins in the 3.3V plane. Alternatively the I2C bus can be switched to the 3.3V_SUS plane as an assembly option. Please contact your MSC representative if you will need this option.

The I2C pins are implemented by bit banging at GPIOs. As a result, the maximal I2C bus speed depends on CPU performance.

2.10.13 Power and System Management

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
PWRBTN#	I	CMOS	3.3V Sus	3.3V	ePU = 10 KΩ iPU = 20 KΩ	Power button to bring system out of or into Suspend states, active on falling edge after 16 ms debounce.	PCH 82QM77/HM76
SYS_RESET#	I	CMOS	3.3V	3.3V	ePU = 10 KΩ	Reset button input. Active after 16 ms debounce.	PCH 82QM77/HM76
CB_RESET#	O	CMOS	3.3V	3.3V	eSR = 22 Ω	Reset output from module to Carrier Board. Active low. Issued by module chipset and may result from a low SYS_RESET# input, a low PWR_OK input, a VCC_12V power input that falls below the minimum specification, a watchdog timeout, or may be initiated by the module software.	PCH 82QM77/HM76
PWR_OK	I	CMOS	3.3V Sus	3.3V	ePU = 220 KΩ	Power OK from main power supply. A high value indicates that the power is good.	Power Good logic
SUS_STAT#	O	CMOS	3.3V Sus	3.3V		Indicates imminent suspend operation; used to notify LPC devices.	PCH 82QM77/HM76
SUS_S3#	O	CMOS	3.3V Sus	3.3V		Indicates system is in Suspend to RAM state. Active low output.	PCH 82QM77/HM76
SUS_S4#	O	CMOS	3.3V Sus	3.3V		Indicates system is in Suspend to Disk state. Active low output.	PCH 82QM77/HM76
SUS_S5#	O	CMOS	3.3V Sus	3.3V		Indicates system is in Soft Off state. Also known as "PS_ON" and can be used to control an ATX power supply.	PCH 82QM77/HM76
WAKE0#	I	CMOS	3.3V Sus	3.3V	ePU = 1.2 KΩ	PCI Express wake up signal.	PCH 82QM77/HM76

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
WAKE1#	I	CMOS	3.3V Sus	3.3V	ePU = 10 KΩ	General purpose wake up signal. May be used to implement wake-up on PS2 keyboard or mouse activity.	PCH 82QM77/HM76 RI#
BATLOW#	I	CMOS	3.3V Sus	3.3V	ePU = 8.2 KΩ	Indicates that external battery is low.	PCH 82QM77/HM76
LID#	I OD	CMOS	3.3V Sus	12V	ePU = 8.2 KΩ	LID switch. Low active signal used by ACPI operating system for LID switch.	PCH 82QM77/HM76 GPIO14
SLEEP#	I OD	CMOS	3.3V Sus	12V	ePU = 8.2 KΩ	Sleep button. Low active signal used by ACPI operating system to bring the system to sleep state or wake it up again.	PCH 82QM77/HM76 GPIO10
THRM#	I	CMOS	3.3V	3.3V	ePU = 10 KΩ	Input from off-module temperature sensor indicating an over-temp situation.	PCH 82QM77/HM76 GPIO0
THERMTRIP#	OD	CMOS	3.3V	3.3V	ePU = 330 Ω	Active low output indicating that the CPU has entered thermal shutdown.	CPU, PCH 82QM77/HM76
SMB_CK	I/O OD	CMOS	3.3V Sus	3.3V	ePU = 2.2 KΩ	System Management Bus bidirectional clock line. Power sourced through 5V standby rail and main power rails.	PCH 82QM77/HM76
SMB_DAT	I/O OD	CMOS	3.3V Sus	3.3V	ePU = 2.2 KΩ	System Management Bus bidirectional data line. Power sourced through 5V standby rail and main power rails.	PCH 82QM77/HM76
SMB_ALERT#	I	CMOS	3.3V Sus	3.3V	ePU = 10 KΩ	System Management Bus Alert – active low input can be used to generate an SMI# (System Management Interrupt) or to wake the system. Power sourced through 5V standby rail and main power rails.	PCH 82QM77/HM76

2.10.14 General Purpose I/O

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
GPI[0:3]	I	CMOS	3.3V	3.3V	ePU = 10 KΩ	General purpose output pins. Upon a hardware reset, these outputs are low.	PCH 82QM77/HM76 GPIO[38, 39, 48, 49]
GPO[0:3]	O	CMOS	3.3V			General purpose input pins. Pulled high internally on the module.	PCH 82QM77/HM76 GPIO[28, 35, 70, 71]

2.10.15 SPI Interface

<table>
<tr><th>Signal</th><th>Pin Type</th><th>Signal Level</th><th>Power Rail</th><th>Rem. / Tol.</th><th>PU/PD/SR</th><th>Description</th><th>Source / Target</th></tr>
<tr><td>SPI_CS#</td><td>O</td><td>CMOS</td><td>3.3V Sus</td><td></td><td>ePU = 10 KΩ</td><td>Chip select for Carrier Board SPI - may be sourced from chipset SPI0 or SPI1.</td><td>PCH 82QM77/HM76</td></tr>
<tr><td>SPI_MISO</td><td>I</td><td>CMOS</td><td>3.3V Sus</td><td>3.3V</td><td>eSR = 47 Ω</td><td>Data in to Module from Carrier SPI.</td><td>PCH 82QM77/HM76</td></tr>
<tr><td>SPI_MOSI</td><td>O</td><td>CMOS</td><td>3.3V Sus</td><td></td><td>eSR = 47 Ω</td><td>Data out from Module to Carrier SPI.</td><td>PCH 82QM77/HM76</td></tr>
<tr><td>SPI_CLK</td><td>O</td><td>CMOS</td><td>3.3V Sus</td><td></td><td>eSR = 47 Ω</td><td>Clock from Module to Carrier SPI.</td><td>PCH 82QM77/HM76</td></tr>
<tr><td>SPI_POWER</td><td>O</td><td>Power</td><td>3.3V Sus</td><td></td><td></td><td>Power supply for Carrier Board SPI – sourced from Module – nominally 3.3V. The Module shall provide a minimum of 100mA on SPI_POWER.
Carriers shall use less than 100mA of SPI_POWER. SPI_POWER shall only be used to power SPI devices on the Carrier.</td><td>PCH 82QM77/HM76</td></tr>
<tr><td>BIOS_DIS [1:0]#</td><td>I</td><td>CMOS</td><td>3.3V Sus</td><td>3.3V</td><td>ePU = 10 KΩ</td><td>Selection straps to determine the BIOS boot device.
<table>
<tr><th>BIOS_DIS[1:0]#</th><th>SPI_CS1# Destination</th><th>SPI_CS0# Destination</th><th>Carrier SPI_CS#</th><th>SPI Descriptor</th><th>BIOS Entry</th></tr>
<tr><td>1 1</td><td>Module</td><td>Module</td><td>HIGH</td><td>Module</td><td>SPI0/SPI1</td></tr>
<tr><td>1 0</td><td>Module</td><td>Module</td><td>HIGH</td><td>Module</td><td>Carrier FWH</td></tr>
<tr><td>0 1</td><td>Module</td><td>Carrier</td><td>SPI0</td><td>Carrier</td><td>SPI0/SPI1</td></tr>
<tr><td>0 0</td><td>Carrier</td><td>Module</td><td>SPI1</td><td>Module</td><td>SPI0/SPI1</td></tr>
</table></td><td>PCH 82QM77/HM76</td></tr>
</table>

2.10.16 Module Type Definition

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
TYPE[0:2]#	O			Type 6 module		The TYPE pins indicate to the Carrier Board the Pin-out Type that is implemented on the module. The pins are tied on the module to either ground (GND) or are no-connects (NC). For Pin-out Type 1, these pins are don't care (X). TYPE2# TYPE1# TYPE0# X X X Pin-out Type 1 NC NC NC Pin-out Type 2 NC NC GND Pin-out Type 3 (no IDE) NC GND NC Pin-out Type 4 (no PCI) NC GND GND Pin-out Type 5 (no IDE, no PCI) **GND NC NC Pin-out Type 6** (no IDE, no PCI) The Carrier Board should implement combinatorial logic that monitors the module TYPE pins and keeps power off (e.g deactivates the ATX_ON signal for an ATX power supply) if an incompatible module pin- out type is detected. The Carrier Board logic may also implement a fault indicator such as a LED.	Carrier board logic
TYPE10#	O			No connect on COM.0 Rev 2.1 Module Type 6		Dual use pin. Indicates to the Carrier Board that a Type 10 Module is installed. Indicates to the Carrier that a Rev 1.0/2.0 Module is installed TYPE10# NC Pin-out R2.0 PD Pin-out Type 10 pull down to ground with 4.7K resistor 12V Pin-out R1.0 This pin is reclaimed from the VCC_12V pool. In R1.0 Modules this pin will connect to other VCC_12V pins. In R2.0 this pin is defined as a no connect for types 1-6. A Carrier can detect a R1.0 Module by the presence of 12V on this pin. R2.0 Module types 1-6 will no connect this pin. Type 10 Modules shall pull this pin to ground through a 4.7K resistor.	Carrier board logic

2.10.17 Power and GND

Signal	Pin Type	Signal Level	Power Rail	Remark / Tolerance	PU/PD/SR	Description	Source / Target
VCC_12V	Power		12V (±5%)			Primary power input: +12V (±5%)	Voltage Regulators
VCC_5V_SBY	Power		5V (±5%)			Standby power input: +5.0V (±5%) If VCC5_SBY is used, all available VCC_5V_SBY pins on the connector(s) shall be used. Only used for standby and suspend functions. May be left unconnected if these functions are not used in the system design.	VCC3.3V SUS regulator
VCC_RTC	Power					Real-time clock circuit-power input : +3.0V (+2.0V to +3.3V)	PCH 82QM77/HM76
GND	Power					Ground - DC power and signal and AC signal return path. All available GND connector pins shall be used and tied to Carrier Board GND plane.	

2.11 Pin List for MSC C6B-7S module (Type 6)

Row A		Row B		Row C		Row D	
A1	GND (FIXED)	B1	GND (FIXED)	C1	GND (FIXED)	D1	GND (FIXED)
A2	GBE0_MDI3-	B2	GBE0_ACT#	C2	GND	D2	GND
A3	GBE0_MDI3+	B3	LPC_FRAME#	C3	USB_SSRX0-	D3	USB_SSTX0-
A4	GBE0_LINK100#	B4	LPC_AD0	C4	USB_SSRX0+	D4	USB_SSTX0+
A5	GBE0_LINK1000#	B5	LPC_AD1	C5	GND	D5	GND
A6	GBE0_MDI2-	B6	LPC_AD2	C6	USB_SSRX1-	D6	USB_SSTX1-
A7	GBE0_MDI2+	B7	LPC_AD3	C7	USB_SSRX1+	D7	USB_SSTX1+
A8	GBE0_LINK#	B8	LPC_DRQ0#	C8	GND	D8	GND
A9	GBE0_MDI1-	B9	LPC_DRQ1#	C9	USB_SSRX2-	D9	USB_SSTX2-
A10	GBE0_MDI1+	B10	LPC_CLK	C10	USB_SSRX2+	D10	USB_SSTX2+
A11	GND (FIXED)	B11	GND (FIXED)	C11	GND (FIXED)	D11	GND (FIXED)
A12	GBE0_MDI0-	B12	PWRBTN#	C12	USB_SSRX3-	D12	USB_SSTX3-
A13	GBE0_MDI0+	B13	SMB_CK	C13	USB_SSRX3+	D13	USB_SSTX3+
A14	GBE0_CTREF	B14	SMB_DAT	C14	GND	D14	GND
A15	SUS_S3#	B15	SMB_ALERT#	C15	DDI1_PAIR6+	D15	DDI1_CTRLCLK_AUX+
A16	SATA0_TX+	B16	SATA1_TX+	C16	DDI1_PAIR6-	D16	DDI1_CTRLDATA_AUX-
A17	SATA0_TX-	B17	SATA1_TX-	C17	RSVD	D17	RSVD
A18	SUS_S4#	B18	SUS_STAT#	C18	RSVD	D18	RSVD
A19	SATA0_RX+	B19	SATA1_RX+	C19	PCIE_RX6+	D19	PCIE_TX6+
A20	SATA0_RX-	B20	SATA1_RX-	C20	PCIE_RX6-	D20	PCIE_TX6-
A21	GND (FIXED)	B21	GND (FIXED)	C21	GND (FIXED)	D21	GND (FIXED)
A22	SATA2_TX+	B22	SATA3_TX+	C22	PCIE_RX7+	D22	PCIE_TX7+
A23	SATA2_TX-	B23	SATA3_TX-	C23	PCIE_RX7-	D23	PCIE_TX7-
A24	SUS_S5#	B24	PWR_OK	C24	DDI1_HPD	D24	RSVD
A25	SATA2_RX+	B25	SATA3_RX+	C25	DDI1_PAIR4+	D25	RSVD
A26	SATA2_RX-	B26	SATA3_RX-	C26	DDI1_PAIR4-	D26	DDI1_PAIR0+
A27	BATLOW#	B27	WDT	C27	RSVD	D27	DDI1_PAIR0-
A28	(S)ATA_ACT#	B28	AC/HDA_SDIN2	C28	RSVD	D28	RSVD
A29	AC/HDA_SYNC	B29	AC/HDA_SDIN1	C29	DDI1_PAIR5+	D29	DDI1_PAIR1+
A30	AC/HDA_RST#	B30	AC/HDA_SDIN0	C30	DDI1_PAIR5-	D30	DDI1_PAIR1-
A31	GND (FIXED)	B31	GND (FIXED)	C31	GND (FIXED)	D31	GND (FIXED)
A32	AC/HDA_BITCLK	B32	SPKR	C32	DDI2_CTRLCLK_AUX+	D32	DDI1_PAIR2+
A33	AC/HDA_SDOUT	B33	I2C_CK	C33	DDI2_CTRLDATA_AUX-	D33	DDI1_PAIR2-
A34	BIOS_DIS0#	B34	I2C_DAT	C34	DDI2_DDC_AUX_SEL	D34	DDI1_DDC_AUX_SEL
A35	THRMTRIP#	B35	THRM#	C35	RSVD	D35	RSVD
A36	USB6-	B36	USB7-	C36	DDI3_CTRLCLK_AUX+	D36	DDI1_PAIR3+
A37	USB6+	B37	USB7+	C37	DDI3_CTRLDATA_AUX-	D37	DDI1_PAIR3-
A38	USB_6_7_OC#	B38	USB_4_5_OC#	C38	DDI3_DDC_AUX_SEL	D38	RSVD
A39	USB4-	B39	USB5-	C39	DDI3_PAIR0+	D39	DDI2_PAIR0+
A40	USB4+	B40	USB5+	C40	DDI3_PAIR0-	D40	DDI2_PAIR0-
A41	GND (FIXED)	B41	GND (FIXED)	C41	GND (FIXED)	D41	GND (FIXED)
A42	USB2-	B42	USB3-	C42	DDI3_PAIR1+	D42	DDI2_PAIR1+
A43	USB2+	B43	USB3+	C43	DDI3_PAIR1-	D43	DDI2_PAIR1-
A44	USB_2_3_OC#	B44	USB_0_1_OC#	C44	DDI3_HPD	D44	DDI2_HPD
A45	USB0-	B45	USB1-	C45	RSVD	D45	RSVD
A46	USB0+	B46	USB1+	C46	DDI3_PAIR2+	D46	DDI2_PAIR2+
A47	VCC_RTC	B47	EXCD1_PERST#	C47	DDI3_PAIR2-	D47	DDI2_PAIR2-
A48	EXCD0_PERST#	B48	EXCD1_CPPE#	C48	RSVD	D48	RSVD
A49	EXCD0_CPPE#	B49	SYS_RESET#	C49	DDI3_PAIR3+	D49	DDI2_PAIR3+
A50	LPC_SERIRQ	B50	CB_RESET#	C50	DDI3_PAIR3-	D50	DDI2_PAIR3-
A51	GND (FIXED)	B51	GND (FIXED)	C51	GND (FIXED)	D51	GND (FIXED)
A52	PCIE_TX5+	B52	PCIE_RX5+	C52	PEG_RX0+	D52	PEG_TX0+
A53	PCIE_TX5-	B53	PCIE_RX5-	C53	PEG_RX0-	D53	PEG_TX0-
A54	GPI0	B54	GPO1	C54	TYPE0#	D54	PEG_LANE_RV#
A55	PCIE_TX4+	B55	PCIE_RX4+	C55	PEG_RX1+	D55	PEG_TX1+
A56	PCIE_TX4-	B56	PCIE_RX4-	C56	PEG_RX1-	D56	PEG_TX1-
A57	GND	B57	GPO2	C57	TYPE1#	D57	TYPE2#
A58	PCIE_TX3+	B58	PCIE_RX3+	C58	PEG_RX2+	D58	PEG_TX2+
A59	PCIE_TX3-	B59	PCIE_RX3-	C59	PEG_RX2-	D59	PEG_TX2-
A60	GND (FIXED)	B60	GND (FIXED)	C60	GND (FIXED)	D60	GND (FIXED)
A61	PCIE_TX2+	B61	PCIE_RX2+	C61	PEG_RX3+	D61	PEG_TX3+
A62	PCIE_TX2-	B62	PCIE_RX2-	C62	PEG_RX3-	D62	PEG_TX3-
A63	GPI1	B63	GPO3	C63	RSVD	D63	RSVD
A64	PCIE_TX1+	B64	PCIE_RX1+	C64	RSVD	D64	RSVD

Row A		Row B		Row C		Row D	
A65	PCIE_TX1-	B65	PCIE_RX1-	C65	PEG_RX4+	D65	PEG_TX4+
A66	GND	B66	WAKE0#	C66	PEG_RX4-	D66	PEG_TX4-
A67	GPI2	B67	WAKE1#	C67	RSVD	D67	GND
A68	PCIE_TX0+	B68	PCIE_RX0+	C68	PEG_RX5+	D68	PEG_TX5+
A69	PCIE_TX0-	B69	PCIE_RX0-	C69	PEG_RX5-	D69	PEG_TX5-
A70	GND (FIXED)	B70	GND (FIXED)	C70	GND (FIXED)	D70	GND (FIXED)
A71	LVDS_A0+	B71	LVDS_B0+	C71	PEG_RX6+	D71	PEG_TX6+
A72	LVDS_A0-	B72	LVDS_B0-	C72	PEG_RX6-	D72	PEG_TX6-
A73	LVDS_A1+	B73	LVDS_B1+	C73	GND	D73	GND
A74	LVDS_A1-	B74	LVDS_B1-	C74	PEG_RX7+	D74	PEG_TX7+
A75	LVDS_A2+	B75	LVDS_B2+	C75	PEG_RX7-	D75	PEG_TX7-
A76	LVDS_A2-	B76	LVDS_B2-	C76	GND	D76	GND
A77	LVDS_VDD_EN	B77	LVDS_B3+	C77	RSVD	D77	RSVD
A78	LVDS_A3+	B78	LVDS_B3-	C78	PEG_RX8+	D78	PEG_TX8+
A79	LVDS_A3-	B79	LVDS_BKLT_EN	C79	PEG_RX8-	D79	PEG_TX8-
A80	GND (FIXED)	B80	GND (FIXED)	C80	GND (FIXED)	D80	GND (FIXED)
A81	LVDS_A_CK+	B81	LVDS_B_CK+	C81	PEG_RX9+	D81	PEG_TX9+
A82	LVDS_A_CK-	B82	LVDS_B_CK-	C82	PEG_RX9-	D82	PEG_TX9-
A83	LVDS_I2C_CK	B83	LVDS_BKLT_CTRL	C83	RSVD	D83	RSVD
A84	LVDS_I2C_DAT	B84	VCC_5V_SBY	C84	GND	D84	GND
A85	GPI3	B85	VCC_5V_SBY	C85	PEG_RX10+	D85	PEG_TX10+
A86	RSVD	B86	VCC_5V_SBY	C86	PEG_RX10-	D86	PEG_TX10-
A87	eDP_HPD	B87	VCC_5V_SBY	C87	GND	D87	GND
A88	PCIE0_CK_REF+	B88	BIOS_DIS1#	C88	PEG_RX11+	D88	PEG_TX11+
A89	PCIE0_CK_REF-	B89	VGA_RED	C89	PEG_RX11-	D89	PEG_TX11-
A90	GND (FIXED)	B90	GND (FIXED)	C90	GND (FIXED)	D90	GND (FIXED)
A91	SPI_POWER	B91	VGA_GRN	C91	PEG_RX12+	D91	PEG_TX12+
A92	SPI_MISO	B92	VGA_BLU	C92	PEG_RX12-	D92	PEG_TX12-
A93	GPO0	B93	VGA_HSYNC	C93	GND	D93	GND
A94	SPI_CLK	B94	VGA_VSYNC	C94	PEG_RX13+	D94	PEG_TX13+
A95	SPI_MOSI	B95	VGA_I2C_CK	C95	PEG_RX13-	D95	PEG_TX13-
A96	TPM_PP	B96	VGA_I2C_DAT	C96	GND	D96	GND
A97	TYPE10#	B97	SPI_CS#	C97	RSVD	D97	RSVD
A98	SER0_TX	B98	RSVD	C98	PEG_RX14+	D98	PEG_TX14+
A99	SER0_RX	B99	RSVD	C99	PEG_RX14-	D99	PEG_TX14-
A100	GND (FIXED)	B100	GND (FIXED)	C100	GND (FIXED)	D100	GND (FIXED)
A101	SER1_TX	B101	FAN_PWNOUT	C101	PEG_RX15+	D101	PEG_TX15+
A102	SER1_RX	B102	FAN_TACHIN	C102	PEG_RX15-	D102	PEG_TX15-
A103	LID#	B103	SLEEP#	C103	GND	D103	GND
A104	VCC_12V	B104	VCC_12V	C104	VCC_12V	D104	VCC_12V
A105	VCC_12V	B105	VCC_12V	C105	VCC_12V	D105	VCC_12V
A106	VCC_12V	B106	VCC_12V	C106	VCC_12V	D106	VCC_12V
A107	VCC_12V	B107	VCC_12V	C107	VCC_12V	D107	VCC_12V
A108	VCC_12V	B108	VCC_12V	C108	VCC_12V	D108	VCC_12V
A109	VCC_12V	B109	VCC_12V	C109	VCC_12V	D109	VCC_12V
A110	GND (FIXED)	B110	GND (FIXED)	C110	GND (FIXED)	D110	GND (FIXED)

	= not supported on MSC C6B-7S modules.

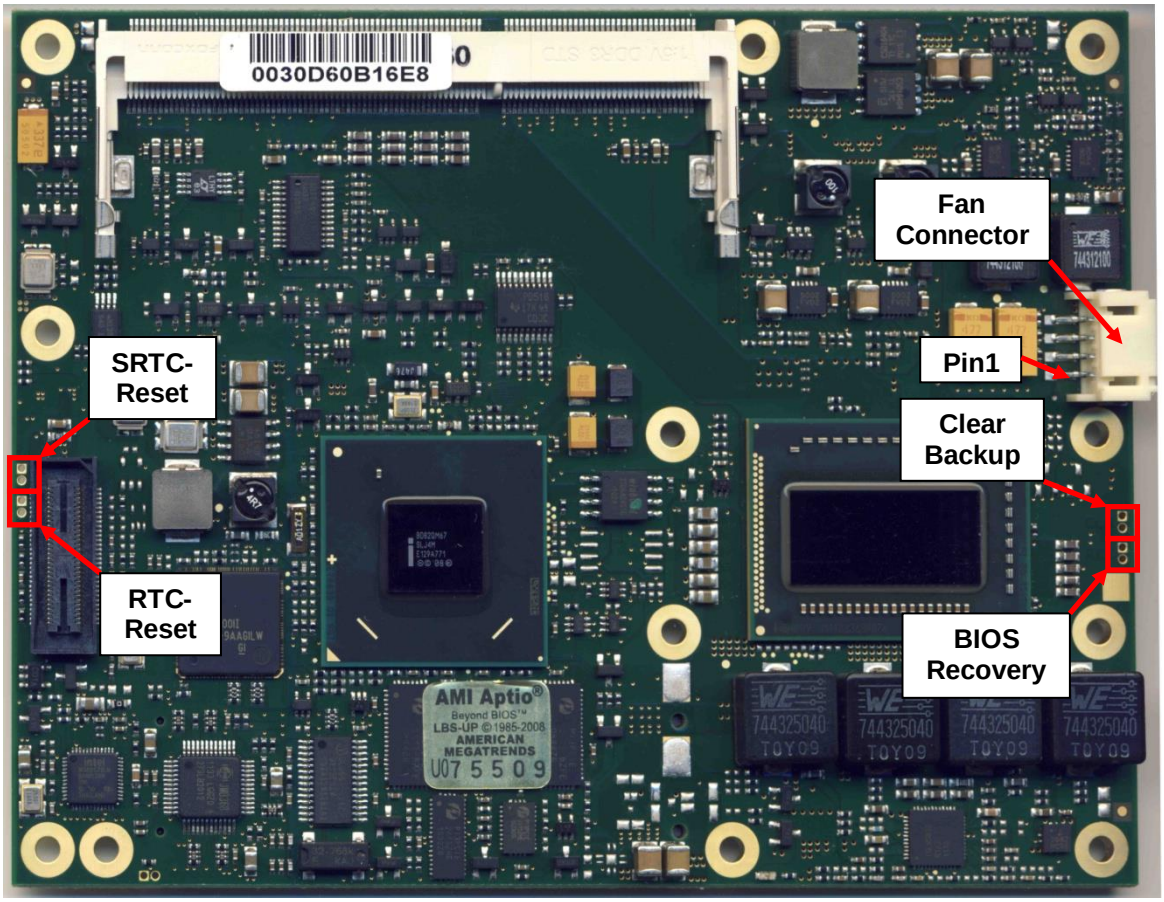
3 Jumpers and Connectors

3.1 Jumpers

There are four jumpers available on the module:

- RTC Reset: By shorting the pins of this jumper, the RTC Clock is reset and the values of the CMOS NV-RAM are cleared.
- SRTC Reset: By shorting the pins of this jumper, the manageability register bits in the CMOS NV-RAM are reset.
- Clear Backup EEPROM: By shorting the pins of this jumper during boot, the values of the Backup EEPROM and the values of the NV-ROM are invalidated, thus forcing the board to start up with default values.
- BIOS Recovery: By shorting the pins of this jumper during boot the system is forced into crisis recovery mode. For more information see chapter 6.5.

These jumpers are located at the top side of the board at the border.



3.2 Fan Connector

The connector of the fan is located at top side of the CPU module, directly beneath the CPU:

The following connector type is used:

- JST S4B-PH-SM4-TB

The fan itself should be equipped with a JST PHR-4 connector and one of the following contact types:

- SPH-002T-P0.5S (AWG# 30-24), SPH-002T-P0.5L (AWG# 28-24) or SPH-004T-P0.5S (AWG# 32-28)

The pinning is as following (numbering from right to left):

Pin	Signal	Description
1	GND	GND
2	V12FAN	+12V fan supply voltage.
3	TACHO	Input for the tacho signal of the fan (O.C.)
4	PWM	Output of the PWM-Signal for fan speed control.

4 Watchdog

The C6B-7S board has a watchdog function implemented in a PIC Microcontroller.

The watchdog can be enabled and configured in the BIOS Setup.

If the watchdog is enabled a counter is started which generates a reset if it is not retriggered within a programmable time window.

Possible watchdog delays: 1s, 5s, 10s, 30s, 1min, 5min, 10min, 30min Possible watchdog timeout: 0.4s, 1s, 5s, 10s, 30s, 1min, 5min, 10min The time delay starts as soon as it is enabled in the BIOS.

MSC provides a software API which gives the application software access to the Watchdog functionality if needed.

5 System resources

5.1 PCI IRQ Routing

		Interrupts of Controller (PCH)								
Slot Number (or Onboard Device)	IDSEL # or DEV/ Func	Bus #	PIRQ0 (INT A)	PIRQ1 (INT B)	PIRQ2 (INT C)	PIRQ3 (INT D)	PIRQ4 (INT E)	PIRQ5 (INT F)	PIRQ6 (INT G)	PIRQ7 (INT H)
Intel Integrated Graphic Device	2/0	0	x							
SA Thermal Device	4/0	0	x							
SATA #0, SATA #1, SATA RAID Controller	1F/2	0						x		
SMBus Controller	1F/3	0							x	
Thermal Controller	1F/6	0							x	
EHCI #0	1D/0	0								x
EHCI #1	1A/0	0						x		
HD Audio	1B/0	0							x	
GbE Controller	19/0	0					x			
Management Engine devices	16/0-3	0					B	C	D	A
PCIE Slot #1 / Lane #0	1C/0	dyn	A	B	C	D				
PCIE Slot #2 / Lane #1	1C/1	dyn	D	A	B	C				
PCIE Slot #3 / Lane #2	1C/2	dyn	C	D	A	B				
PCIE Slot #4 / Lane #3	1C/3	dyn	B	C	D	A				
PCIE Slot #5 / Lane #4	1C/4	dyn	A	B	C	D				
PCIE Slot #6 / Lane #5	1C/5	dyn	D	A	B	C				
PCIE Slot #7 / Lane #6	1C/6	dyn	C	D	A	B				
P.E.G. Port Slot x16 (if used)	1/0	dyn	A	B	C	D				
P.E.G. Port Slot x8 (if used)	1/0	dyn	D	A	B	C				
P.E.G. Port Slot x4 (if used)	1/0	dyn	C	D	A	B				

Note: x means that this Interrupt is used by an internal chipset device, e.g. the Intel Graphics Device is connected to PIRQ0 and uses Interrupt A.

Chipset internal devices are connected to PIRQ0 and PIRQ4-7.

PIRQ1-3 are not shared with chipset devices. So PCIe lane #1, lane #2 and lane #3 are not shared if lane #5 and lane #6 are not used.

Note: The assignment of the PCI Express slots to the ComExpress connector is 1:1.

Chipset PCIe lane 0 is connected to ComExpress connector lane 0. Chipset PCIe lane 1 is connected to ComExpress lane 1 and so on.

Note: PCIe lane 7 is used for internal Lan device.

5.2 IRQ Lines in APIC Mode

IRQ#	Available	Typical Interrupt Source	Connected to Pin
0	No	Counter 0	
1	No	Keyboard	
2	No	Cascade Interrupt from Slave PIC	
3	Yes		
4	Yes		
5	Yes		
6	Yes		
7	Yes		
8	No	RTC	
9	Yes	shared SCI	
10	Yes		
11	Yes		
12	Yes		
13	No	Math processor	
14	Yes		
15	Yes		
16	Yes		INT A
17	Yes		INT B
18	Yes		INT C
19	Yes		INT D
20	Yes		INT E
21	Yes		INT F
22	Yes		INT G
23	Yes		INT H

5.3 SMB Address Map

Device	Address *)
HW-Monitor (ADT7490)	5C / 27h
CMOS Backup EEPROM	A8h / 54h AAh / 55h
SO-DIMM 0 SPD EEPROM	A0h / 50h
SO-DIMM 1 SPD EEPROM	A4h / 52h

*) 8 bit address (with R/W) / 7 bit address (without R/W).

6 BIOS

6.1.1 Introduction

This guide describes the AMI Aptio Setup Startup screen and contains information on how to access Aptio setup to modify the settings which control AMI pre-OS (operating system) functions.

6.1.2 Startup Screen Overview

The AMI Aptio Startup screen is a graphical user interface (GUI) that is included in AMI Aptio products. The default bios behavior is to show an informational text screen during bios POST phase, but the graphical boot screen can be enabled in the bios setup. The standard boot screen is a black screen without any logo.

6.1.3 Activity Detection Background

While the startup screen is displayed, press the Setup Entry key (ESC or DEL). The system acknowledges the input, and at the end of POST, the screen clears and setup launches.

6.1.4 Aptio Setup Utility

With the AMI Aptio Setup program, you can modify Aptio settings and control the special features of your computer. The setup program uses a number of menus for making changes and turning the special features on or off. This chapter provides an overview of the setup utility and describes at a high-level how to use it.

6.1.5 Configuring the System BIOS

To start the AMI Aptio Setup utility, press [ESC or DEL] to launch Setup. The setup main menu appears.

The BIOS Menu Structure

The BIOS Menu is structured in the following way:

	Main
	MSC Board Info
	Hardware Monitoring Measurement
	Advanced
	PCI Subsystem Settings
	ACPI Settings
	Trusted Computing
	CPU Configuration
	SATA Configuration
	Thermal Configuration
	Intel ® Rapid Start Technology
	Intel TXT(LT) Configuration
	PCH-FW Configuration
	AMT Configuration
	USB Configuration
	Smart Settings
	WB627 SIO Configuration
	HWM ADT7490 Configuration
	PIC Watchdog Configuration
	Serial Port Console Redirection
	Intel ICC
	Chipset
	PCH-IO Configuration
	System Agent (SA) Configuration
	Boot
	Security
	Save & Exit

The Menu Bar

The Menu Bar at the top of the window lists these selections:

Menu Items	Description
Main	Use this menu for basic system information.
Advanced	Use this menu to set the Advanced Features available on your system's chipset.
Chipset	Use this menu to set Chipset Features.
Security	Use this menu to set User and Supervisor Passwords and the Backup and Virus-Check reminders.
Boot	Use this menu to set the boot order in which the BIOS attempts to boot to OS.
Save & Exit	Saves and Exits the Aptio setup utility.

Use the left and right arrow keys on your keyboard to make a menu selection.

The Legend Bar

Use the keys listed in the legend bar on the right side of the screen to make your selections, or to exit the current menu. The following table describes the legend keys and their alternates:

Key	Function
Esc	Exit submenu / Exit Setup utility without saving..
Left and right arrow keys	Select Screen.
Up and down arrow keys	Select Item.
+/-	Change Option.
F1	General Help window.
F2	Previous Values
F3	Optimized Defaults
F4	Save and Exit

Select an item

To select an item, use the arrow keys to move the cursor to the field you want. Then use the plus-and-minus value keys to select a value for that field. Alternatively the Enter key can be used to select a value from a Pop Up menu. The Save Values commands in the Exit Menu save the values currently displayed in all the menus.

Display a submenu

To display a submenu, use the arrow keys to move the cursor to the sub menu you want. Then press Enter. A pointer marks all submenus.

6.1.6 The Main Menu

You can make the following selections on the Main Menu itself. Use the sub menus for other selections.

Feature	Options	Description
Bios Vendor	Informative	Shows the Bios Vendor
Core Version	Informative	Shows the Aptio Core Version
Compliancy	Informative	Shows the UEFI Compliance Version
Project Version	Informative	Shows the Project Version
Build Date	Informative	Shows the Build Date
Access Level	Informative	This feature shows what kind of user has entered the Aptio setup. It depends on the Security Tab if a Administrator and/or User password is set.
System Language	English	Select the system default language
System Date	Enter Date (MM:DD:YYYY)	Set the system date on the real time clock.
System Time	Enter Time (HH:MM:SS)	Set the system time on the real time clock.
MSC Board Info	Submenu	Shows board specific information
Processor Information	Informative	Shows several information of the processor, the VBIOS and Memory.
PCH Information	Informative	Shows information of the Platform Controller Hub.
ME FW Version	Informative	Shows the ME firmware version
ME Firmware SKU	Informative	Shows the ME firmware SKU
SPI Clock Frequency	Informative	Shows the SPI clock frequencies.

6.1.6.1 MSC Board Info

Feature	Options	Description
Manufacturer	MSC Technologies GmbH	
Board Name	Informative	Shows the board name
Board Revision	Informative	Shows the board revision
Bios Version	Informative	Shows the bios version
Serial Number	Informative	Shows the boards serial number
Boot Counter	Informative	Shows the amount of boots
Onboard Lan MAC adresse	Informative	Shows the onboard Lan MAC adresse.
UUID	Informative	Shows the UUID

6.1.6.2 Hardware Monitoring Measurement

Feature	Options	Description
CPU Temperature	Informative	Shows CPU Temperature Also supported in EAPI
Memory Temperature	Informative	Shows Memory Temperature
System Temperature	Informative	Shows System Temperature Also supported in EAPI
Board Temperature	Informative	Shows Board Temperature
VCore	Informative	Shows the VCore voltage
3.3V	Informative	Shows the current 3.3V voltage
5V Standby	Informative	Shows the current 5V Standby voltage
12V	Informative	Shows the current 12V voltage.
CPU Fan Speed	Informative	Shows the current fan speed
System Fan Speed	Informative	Shows the current fan speed.

6.1.7 The Advanced Menu

Feature	Options	Description
PCI Subsystem Settings	Submenu	PCI, PCI-X and PCI Express settings
ACPI Settings	Submenu	System ACPI Parameters
Trusted Computing	Submenu	Trusted Computing (TPM) settings
CPU Configuration	Submenu	CPU Configuration Parameters
CPU PPM Configuration	Submenu	CPU PPM Configuration
SATA Configuration	Submenu	AHCI SATA Configuration settings
Thermal Configuration	Submenu	Thermal Configuration parameters
Internal GOP Configuration	Submenu	Internal GOP Parameters
Intel ® Rapid Start Technology	Submenu	Intel ® Rapid Start Technology
Intel TXT(LT) Configuration	Submenu	Intel Trusted Ececution Technology
PCH-FW Configuration	Submenu	Configure Management Engine Technology parameters
AMT Configuration	Submenu	Configure Active Management Technology parameters
USB Configuration	Submenu	USB configuration parameters
SMART Settings	Submenu	SMART settings
WB627 SIO Configuration	Submenu	Submenu for Super-IO Winbond W82627
HWM ADT7490 Configuration	Submenu	Configuration of the ADT7490 Hardware Monitor
PIC Watchdog	Submenu	Configuration of the PIC Watchdog
Serial Port Console Redirection	Submenu	Serial Port Console Redirection settings
Intel ICC	Submenu	Integrated clock control options

6.1.7.1 PCI Subsystem Settings Submenu

Feature	Options	Description
Above 4G Decoding	Enabled, Disabled	Enables or disables 64bit capable devices to be decoded in above 4G address space (only if system supports 64bit PCI decoding).
PCI Latency Timer	32, 64, 96, 128, 160, 192, 224, 248 PCI bus clocks	Set this value to change the PCI bus clocks. Default is 32 PCI bus clocks
VGA Palette Snoop	Enabled, Disabled	Set this value to change the PCI bus clocks. Default is 32 PCI Bus clocks
PERR# Generation	Enabled, Disabled	Enables or disables PCI Device to generate PERR#.
SERR# Generation	Enabled, Disabled	Enables or disables PCI Device to generate SERR#.
PCI Express Settings	Submenu	Configure PCI Express

6.1.7.1.1 PCI Express Settings

Feature	Options	Description
Relaxed Ordering	Enabled, Disabled	Enables or disables PCI Express Device Relaxed Ordering..
Extended Tag	Enabled, Disabled	If enabled allows device to use 8-bit Tag field as a requester
No Snoop	Enabled, Disabled	Enables or disables PCI Express Device No Snoop option
Maximum Payload	Auto, 128, 256, 512, 1024, 2048. 4096 Bytes	Set maximum payload of PCI Express Device or allow system Bios to select the value
Maximum Read Request	Auto, 128, 256, 512, 1024, 2048. 4096 Bytes	Set read request size of PCI Express Device or allow system Bios to select the value
ASPM Support	Disabled, Auto, Force L0s	Set the ASPM level: Force L0s State: Auto: Bios configures ASPM Force L0s: L0s will be forced Disabled: No ASPM will be used
Extended Synchronization	Enabled, Disabled	Enabled allows generation of extended synchronization patterns

Feature	Options	Description
Link Training Retry	Disabled, 2, 3, 5	Defines number of retry. Attempt software will take to retrain the link if previous training attempt was unsuccessful.
Link Training Timeout	10us to 10000us	Defines number of microseconds software will wait before polling “Link Training” bit in link status register. Value range from 10 to 1000us.
Unpopulated Links	Kepp Link ON, Disable Link	In order to save power, software will disable unpopulated PCI Express links, if this option set to disabled.

6.1.7.2 ACPI Settings

Feature	Options	Description
Enable Hibernation	Enabled, Disabled	Enables or disables system ability to Hibernate (OS/S4 Sleep State). This option may not effective with some OS.
ACPI Sleep State	Suspend Disabled, S1 only (CPU Stop Clock), S3 only (Suspend to RAM) Both S1 and S3 available to choose from OS	Select the highest ACPI Sleep state the system will enter, when the Suspend button is pressed.
Lock Legacy Resources	Enabled, Disabled	Enables or disables lock of Legacy parameters.
S3 Video Repost	Enabled, Disabled	Enable or disable S3 Video Repost.

6.1.7.3 Trusted Computing

Feature	Options	Description
TPM Support	Enabled, Disabled	Enables or disables TPM support. OS will not show TPM. Note: Reset of platform is required to see more TPM options For more information see also technotes in chapter 6.7
TPM state	Enabled, Disabled	Turn TPM Enable/Disable. NOTE: Your Computer will reboot during restart in order to change State of TPM.
Pending Operation	None, Enable take ownership Disable take ownership TPM clear	Schedule an operation for the Security Device. **Note**: Your computer will reboot during restart in order to change State of Security Device.

6.1.7.4 CPU Configuration

Note: Dependent on used CPU, available setup options may vary

Feature	Options	Description
Hyper-Threading	Enabled, Disabled	Enabled for Windows XP and Linux (OS optimized for Hyper-Threading Technology) and Disabled for other OS (OS not optimized for Hyper-Threading Technology).
Active Processor Core	All, 1, 2, n	Number of cores to enable in each processor package All: All logical processors will be enabled n = max. cores - 1
Limit CPUID Maximum	Enabled, Disabled	Disabled for Windows XP
Execute Disable Bit	Enabled, Disabled	XD can prevent certain classes of malicious buffer overflow attacks when combined with a supporting OS
Intel Virtualization Technology	Enabled, Disabled	When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology For more information see also technotes in chapter 6.7
Hardware Prefetcher	Enabled, Disabled	To turn on/off the Mid Level Cache (L2) streamer prefetcher.
Adjacent Cache Line Prefetch	Enabled, Disabled	To turn on/off prefetching of adjacent cache lines.
TCC Activation offset	Value	Offset from the TCC activation temperature.

6.1.7.5 CPU Power Management

Feature	Options	Description
EIST	Enabled, Disabled	Enable or disable Intel Speedstep For more information see also technotes in chapter 6.7
Turbo Mode	Enabled, Disabled	Enable or disable Turbo Mode. For more information see also technotes in chapter 6.7
CPU C3 Report	Enabled, Disabled	Enable or disable CPU C3(ACPI C2) report to OS
CPU C6 Report	Enabled, Disabled	Enable or disable CPU C6(ACPI C3) report to OS
CPU C7 Report	Enabled, Disabled	Enable or disable CPU C7(ACPI C3) report to OS
Configurable TDP	TDP Nominal, TDP Down, TDP Up, Disabled	Allow reconfiguration of TDP levels base on current power and thermal delivery capabilities of the system. Note: This setting appears only on specific Celeron CPU's. Example for Celeron 3217UE: TDP Nominal: TDP is in short duration 4W above normal TDP. After this time TDP is normal until system load ends and starts again. TDP Down: TDP is in short duration 4W above normal TDP. After this time TDP is 4W under normal TDP until system load ends and starts again. TDP up and disabled is same as nominal for this CPU.
Config TDP LOCK	Enabled, Disabled	Lock the Config TDP control register
Long duration power limit	0 – x	Long duration power limit in Watts. 0 means use factory defaults. Min and max value depends on type of CPU.
Long duration maintained	0-x	Time window in seconds which the short duration power is maintained
Short duration power limit	0-x	Short duration power limit in Watts. 0 means use factory defaults. Min and max value depends on type of CPU.

Feature	Options	Description
ACPI T State	Enabled, Disabled	Enable or disable ACPI T state support

6.1.7.6 SATA Configuration

Feature	Options	Description
SATA Controller(s)	Enabled, Disabled	Enable or disable SATA DEVICE
SATA Mode Selection	AHCI, IDE, RAID	Software Feature Mask Configuration For more information see also technotes in chapter 6.7
SATA Test Mode	Enabled, Disabled	Enable or disable Test Mode. Note: If you have problems with your Sata Device, try to enable Test Mode.
Aggressive LPM Support	Enabled, Disabled	Enable PCH to aggressively enter link power state.
SATA Controller Speed	Gen1, Gen2, Gen3	Indicates the maximum speed the SATA controller can support. Note: For GEN3 it is highly recommended to use SATA3 cables.
Port x (Port 0-4)	Enabled, Disabled	Enable or disable SATA Port
Hot Plug (Port 0-4)	Enabled, Disabled	Designates this port as HOT pluggable.
External SATA (Port 0-4)	Enabled, Disabled	External SATA Support.
SATA Device Type (Port 0-1)	Hard Disk Driver, Solid State Driver	Identify the SATA port is connected to Solid State Drive or Hard Disk Drive.
Spin Up Device (Port 0-4)	Enabled, Disabled	On an edge detect from 0 to 1, the PCH starts a COMRESET initialization sequence to the device.

6.1.7.8 Thermal Configuration

Feature	Options	Description
SMBusBuffer Lenth	1,2,5,9,10,14,20	SMBus Block Read message lenght
Thermal Reporting Packet Error	Enabled, Disabled	Enable Packet Error Checking (PEC) for SMBus Block Read
DIMM1 TS Read	Enabled, Disabled	DIMM1 Thermal Sensor Read
DIMM2 TS Read	Enabled, Disabled	DIMM2 Thermal Sensor Read
PCH Thermal Device	Enabled, Disabled	Enable or disable PCH Thermal Device (D31:F6)
PCH Temp Read	Enabled, Disabled	PCH Temperature Read enable
CPU Energy Read	Enabled, Disabled	CPU Energy Read enable
CPU Temp Read	Enabled, Disabled	CPU Temperature Read enable

6.1.7.9 Internal GOP Configuration

Feature	Options	Description
GOP Output Select	LVDS1+CRT1, HDMI, DP CRT1, LVDS1	Select GOP Output devices.

6.1.7.10 Intel® Rapid Start Technology

Feature	Options	Description
Intel® Rapid Start	Enabled, Disabled	Enable or disable Intel® Rapid Start technology For more information see also technotes in chapter 6.7

6.1.7.11 Intel Trusted Execution Technology

Feature	Options	Description
Secure Mode Extensions	Enabled,	Intel CPU SMX Support.
Intel TXT(LT) Support	Enabled, Disabled	Enables or Disables Intel(R) TXT(LT) support. For more information see also technotes in chapter 6.7

6.1.7.12 PCH-FW Configuration

Feature	Options	Description
MDES Bios Status Code	Enabled, Disabled	Enable or disable MDES Bios Status Code.
Firmware Update Configuration	Submenu	Configure Management Engine Technology parameters

6.1.7.13 Firmware Update Configuration Submenu

Feature	Options	Description
Me FW Image Re-Flash	Enabled, Disabled	Enable/Disable ME FW Image Re-Flash function. **Note**: Enable this option if Bios update requires an update of the Intel Management Engine (ME). See the Readme.txt which comes with the actual Bios file.

6.1.7.14 AMT Configuration

Feature	Options	Description
Intel AMT	Enabled, Disabled	Enable/Disable Intel (R) Active Management Technology BIOS Extension. Note: iAMT H/W is always enabled. This option just controls the BIOS extension execution. If enabled, this requires additional firmware in the SPI device Note: To configure AMT settings, press CTRL-P after System powered on. For more information see also technotes in chapter 6.7
BIOS Hotkey Pressed	Enabled, Disabled	OEMFLag Bit 1: Enable/Disable BIOS hotkey press.
MEBx Selection Screen	Enabled, Disabled	OEMFLag Bit 2: Enable/Disable MEBx selection screen.

Feature	Options	Description
Hide Un-Configure ME	Enabled, Disabled	OEMFlag Bit 6: Hide Un-Configure ME without password Confirmation Prompt
MEBx Debug Message Output	Enabled, Disabled	OEMFlag Bit 14: Enable MEBx debug message output.
Un-Configure ME	Enabled, Disabled	OEMFlag Bit 15: Un-Configure ME without password.
Amt Wait Timer	Value	Set timer in seconds to wait before sending ASF_GET_BOOT_OPTIONS.
Disable ME	Enabled, Disabled	Set ME to Soft temporary disabled
ASF	Enabled, Disabled	Enable/Disable Alert Specification Format.
Activate Remote Assistence	Enabled, Disabled	Trigger CIRA boot.
USB Configure	Enabled, Disabled	Enable/Disable USB Configure function.
PET Progress	Enabled, Disabled	User can Enable/Disable PET Events progress to receive PET events or not.
Watchdog	Enabled, Disabled	Enable or disable Watchdog timer.

6.1.7.15 USB Configuration

Feature	Options	Description
Legacy USB Support	Auto, Enabled, Disabled	Enables Legacy USB support. AUTO option disables legacy support if no USB devices are connected. DISABLE option will keep USB devices available only for EFI applications.
USB 3.0 Support	Enabled, Disabled	Enable / disable USB 3.0 (XHCI) controller support.
XHCI Hand-off	Enabled, Disabled	This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
EHCI Hand-off	Enabled, Disabled	This is a workaround for OSes without EHCI hand-off support. The EHCI

Feature	Options	Description
		ownership change should be claimed by EHCI driver.
Port 60/64 Emulation	Enabled, Disabled	Enables I/O port 60h/64h emulation support. This should be enabled for the complete USB keyboard legacy support for non-USB aware OSes.
USB transfer time-out	1,5,10,20 sec	The time-out value for Control, Bulk, and Interrupt transfers.
Device reset time-out	10,20,30,40 sec	USB mass storage device Start Unit command time-out.
Device power-up delay	Auto, Manual	Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a Root port it is 100 ms, for a Hub port the delay is taken from Hub descriptor.
Device power-up delay	Value 1-40	Delay range is 1…40 seconds, in one second increments.
USB Mass Storage Device (e.g. USB Stick)	Auto, Floppy, Forced FDD, Hard Disk, CD-ROM	Select Mass storage device emulation type. Auto enumerates devices according to their media format. Optical drives are emulated as CDROM, drives with no media will be emulated according to a drive **Note: This option is appears only if a USB storage device is connected.**

6.1.7.16 Smart Settings

Feature	Options	Description
Smart Self Test	Enabled, Disabled	Run Smart Self Test on all HDDs during Post.

6.1.7.17 WB627 SIO Configuration

Feature	Options	Description
COM A:	Enabled, Disabled	Enable or disable COM A on Winbond SIO
COM A Setting:	Auto, I/O 3F8h, IRQ 4 I/O 3F8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12 I/O 2F8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12 I/O 3E8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12 I/O 2E8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12	Resource setting for COM A on Winbond SIO
COM B:	Enabled, Disabled	Resource setting for COM A on Winbond SIO
COM B Setting:	Auto, I/O 2F8h, IRQ 3 I/O 3F8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12 I/O 2F8h, IRQ 3, 4, 5, 6, 7 ,8,10, 11, 12 I/O 3E8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12 I/O 2E8h, IRQ 3, 4, 5, 6, 7 ,10, 11, 12	Resource setting for COM A on Winbond SIO
COM B Mode:	Normal, IrDA1-2 ASK-IR 1-4	Mode Setting for COM B on Winbond SIO
LPT:	Disabled, Enabled	Enable or disable LPT on Winbond SIO
LPT Setting:	Auto, I/O 378h, IRQ 5, 7 I/O 278, IRQ 5, 7	Resource setting for LPT A on Winbond SIO

Feature	Options	Description
LPT Mode:	SPP, EPP 1.9, ECP, ECP + EPP 1.9, Printer Mode, EPP 1.7, ECP+EPP 1.7	Mode setting for LPT on Winbond SIO

6.1.7.18 HWM ADT7490 Configuration

Feature	Options	Description
Fan 1 Control	Temperature based, Manual	Define how the fan should be controlled: manually set to a fixed duty cycle, or temperature based auto control.
Temperature Source	CPU, Board	Fan is controlled by either CPU or board temperature
Minimum Fan Speed	25%, 50%,100%	Set the fan duty cycle for manual fan control. Note: Only possible if Fan 1 Control is set to manual.
Fan 3 Control	Temperature based, Manual	Define how the fan should be controlled: manually set to a fixed duty cycle, or temperature based auto control.
Temperature Source	CPU, Board	Fan is controlled by either CPU or board temperature
Minimum Fan Speed	25%, 50%,100%	Set the fan duty cycle for manual fan control. Note: Only possible if Fan 1 Control is set to manual.
CPU Low Temperature	30°C, 40°C, 50°C, 60°C	Temperature (in degrees Celsius) when exceeded controls fan to minimum speed
CPU High Temperature	70°C, 80°C	Temperature (in degrees Celsius) when exceeded controls fan to maximum speed
CPU Temperature Hysteresis	4°C, 5°C, 6°C, 8°C	The value (in degree Celsius) that the temperature has to fall below a certain threshold before minum fan speed will be enabled
Board Low Temperature	30°C, 40°C, 50°C, 60°C	Temperature (in degrees Celsius) when exceeded controls fan to minimum speed
Board High Temperature	70°C, 80°C	Temperature (in degrees Celsius) when exceeded controls fan to maximum speed
Board Temperature Hysteresis	4°C, 5°C, 6°C, 8°C	The value (in degree Celsius) that the temperature has to fall below a certain threshold before minum fan speed will be enabled

6.1.7.19 PIC Watchdog Configuration

Feature	Options	Description
Watchdog Start on Boot	Enabled, Disabled	Select if the watchdog should be started at the end of Post before OS is booted
Watchdog Timeout	0.4s, 1s, 5,s 10s, 30s, 1min, 5min, 10min	Select the maximum watchdog trigger period. If the watchdog will not be triggered during selected period, system reset will be generated.
Watchdog Delay	1s, 5,s 10s, 30s, 1min, 5min, 10min, 30min	After the watchdog is activated, it waits the selected delay time before starting to decrement the timeout period.

6.1.7.20 Serial Port Console Redirection

Feature	Options	Description
Com 0 Console Redirection	Enabled, Disabled	Console Redirection Enable or Disable
Console Redirection settings Com 0	Submenu	The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.
Com1 Console Redirection	Enabled, Disabled	Console Redirection Enable or Disable
Console Redirection Settings Com1	Submenu	The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.
Serial Port for Out-of Band Management/Windows Emergency Management Service (EMS) Console Redirection	Enabled, Disabled	Console Redirection Enable or Disable
Console Redirection Settings	Submenu	The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.

6.1.7.20.1 Console Redirection Settings COM0 Submenu

Feature	Options	Description
Terminal Type	ANSI, VT100, VT100+, VT-UTF8	Emulation: ANSI: Extended ASCII char set. VT100: ASCII char set. VT100+: Extends VT100 to support color, function keys, etc. VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.
Bits per second	9600, 19200, 38400, 57600, 115200	Selects serial port transmission speed. The speed must be matched on the other side. Long or noisy lines may require lower speeds.
Data Bits	7, 8	Data Bits
Parity	None, Even, Odd, Mark, Space	A parity bit can be sent with the data bits to detect some transmission errors. Even: parity bit is 0 if the num of 1's in the data bits is even. Odd: parity bit is 0 if num of 1's in the data bits is odd. Mark: parity bit is always 1. Space: Parity bit is always 0. Mark and Space Parity do not allow for error detection. They can be used as an additional data bit.
Stop Bits	1,2	Stop bits indicate the end of a serial data packet. (A start bit indicates the beginning). The standard setting is 1 stop bit. Communication with slow devices may require more than 1 stop bit.
Flow Control	None, Hardware RTS/CTS,	Flow control can prevent data loss from buffer overflow. When sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow. Once the buffers are empty, a 'start' signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signals.
VTUF8 Combo Key Support	Enabled, Disabled,	Enable VT-UF8 Combination Key Support for ANSI/VT100 terminals
Recorder Mode	Disabled, Enabled	With this mode enabled only text will be sent. This is to capture Terminal data.
Resolution 100x31	Disabled, Enabled	Enables or disables extended terminal resolution
Legacy OS Redirection	80x24, 80x25	On Legacy OS, the number of rows and Columns supported redirection
Putty KeyPad	VT100, Linux, XTERMR6, SCO, ESCN, VT400	Select FunctionKey and KeyPad on Putty.

6.1.7.20.2 Console Redirection EMS

Feature	Options	Description
Out-of-Band Mgmt Port	COM0, COM1	Microsoft Windows Emergency Management Services (EMS) allows for remote management of a Windows Server OS through a serial port.
Terminal Type	ANSI, VT100, VT100+, VT-UTF8	Emulation: ANSI: Extended ASCII char set. VT100: ASCII char set. VT100+: Extends VT100 to support color, function keys, etc. VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.
Bits per second	9600, 19200, 57600, 115200	Selects serial port transmission speed. The speed must be matched on the other side. Long or noisy lines may require lower speeds.
Flow Control	None, Hardware RTS/CTS, Software Xon/Xoff	Flow control can prevent data loss from buffer overflow. When sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow. Once the buffers are empty, a 'start' signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signals.

6.1.7.21 Intel ICC

Feature	Options	Description
Use Watchdog Timer for ICC	Disabled, Enabled	Enable Watchdog Timer operation for ICC. If enabled, Watchdog Timer will be started after ICC-related changes. This timer detects platform instability caused by wrong clock settings.
Turn off unused PCI/P	Disabled, Enabled	Disabled: all clocks turned on. Enabled : clocks for empty PCI/PCIe slots will be turned off to save power. Platform must be powered off for changes to take effect.
Lock ICC registers	Static only, All Registers	All registers: all ICC registers will be locked. Static only - only static ICC registers will be locked.
DIV-1S	Submenu	Informative (GFX)
DIV-2S	Submenu	Control Spread Spectrum (BCLK, DMI, PEG, PCIe, SATA, USB)
DIV3	n/a	Informative (not used)
DIV4	n/a	Informative (GFX Bending)
DIV-1NS	n/a	Informative (GFX)
DIV-2NS	n/a	Informative (BCLK, DMI, PEG, PCIe, SATA, USB)

6.1.7.22 DIV -2S Submenu

Feature	Options	Description
New SSC Mode	Down, up, center	Requested SSC mode. Changes will not be applied unless ‘Accept changes’ is pressed.
New Spread percentage	0-50	Requesed SSC in percent in 0.01% increments. Changes will not be applied unless ‘Accept changes’ is pressed.
Apply settings immediately	-	Changes will be applied immediately, but forgotten after reboot. This mode of making changes is more likely to cause platform instability and spontaneous restart.
Apply settings permanently after reboot	-	Changes will be applied permanently, starting after the next reboot. Use it to provide changes that are verified and safe.

6.1.8 Chipset

Feature	Options	Description
PCH-IO Configuration	Submenu	PCH parameters
System Agent (SA) Configuration	Submenu	System Agent (SA) parameters

6.1.9 PCH-IO Configuration

Feature	Options	Description
PCI Express Configuration	Submenu	PCI Express Configuration settings
USB Configuration	Submenu	USB Configuration settings
PCH Azalia Configuration	Submenu	PCH Azalia Configuration settings.
Bios Security Configuration	Submenu	Bios Security Configuration settings
PCH LAN Controller	Enabled, Disabled	Enable or disable onboard NIC.
Wake on LAN	Enabled, Disabled	Enable or disable integrated LAN to wake the system.

Feature	Options	Description
Board Capability	SUS_PWR_DN_ACK, DeepSx	Board Capability - SUS_PWR_DN_ACK -> Send Disabled to PCH, DeepSx -> Show DeepSx Policies
Display Logic	Enabled, Disabled	Enable or disable the PCH Display logic.
CLKRUN# Logic	Enabled, Disabled	Enable the CLKRUN# logic to stop the PCI clocks.
SB CRID	Enabled, Disabled	Enable or disable the PCH Display logic.
High Precision Timer	Enabled, Disabled	Enable or disable the High Precision Event Timer.
Restore AC Power Loss	Power Off, Power On, Last State	Select AC power state when power is re-applied after a power failure. **Note: This setting will only work if RTC battery is used. Otherwise system will always power on after power failure.**

6.1.9.1 PCI Express Configuration

Feature	Options	Description
PCI Express Clock Gate	Enabled, Disabled	Enable or disable PCI Express Clock Gating for each root port.
DMI Link ASPM Control	Disabled,L0, L0sL1	The control of Active State Power Management on both NB side and SB side of the DMI Link.
DMI Link Extended Syn	Enabled, Disabled	The control of Extended Synch on SB side of the DMI Link.
PCIe-USB Glitch W/A	Enabled, Disabled	PCIe-USB Glitch W/A for bad USB devices connected behind PCIe/PEG Port.
Subtractive Decode	Disabled, Enabled	Enable or disable PCI Express Subtractive Decode
PCI Express Root Port x (0-7)	Submenu	Control the PCI Express Root Port.

6.1.9.1.1 PCI Express Root Port x (0-7) Submenu

Feature	Options	Description
PCI Express Root Port	Enabled, Disabled	Control the PCI Express Root Port.
ASPM Support	Disabled,L0s, L1, L0sL1, Auto	Set the ASPM Level: Force L0 - Force all links to L0 State : AUTO - BIOS auto configure : DISABLE - Disables ASPM For more information see also technotes in chapter 6.7
URR	Enabled, Disabled	Enable or disable PCI Express Unsupported Request Reporting.
FER	Enabled, Disabled	Enable or disable PCI Express Device Fatal Error Reporting.
NFER	Enabled, Disabled	Enable or disable PCI Express Device Non-Fatal Error Reporting.
CER	Enabled, Disabled	Enable or disable PCI Express Device Correctable Error Reporting.
CTO	Enabled, Disabled	Enable or disable PCI Express Completion Timer TO.
SEFE	Enabled, Disabled	Enable or disable Root PCI Express System Error on Fatal Error.
SENFE	Enabled, Disabled	Enable or disable Root PCI Express System Error on Non-Fatal Error.
SECE	Enabled, Disabled	Enable or disable Root PCI Express System Error on Correctable Error.
PME SCI	Enabled, Disabled	Enable or disable PCI Express PME SCI.
Hot Plug	Enabled, Disabled	Enable or disable PCI Express Hot Plug.
PCIe Speed	Gen1, Gen2	Select PCI Express port Speed
Extra Bus Reserved	0-7	Extra Bus Reserved (0-7) for bridges behind this Root Bridge.
Reserved Memory	1-20MB	Reserved Memory and Prefetchable Memory (1-20MB) Range for this Root Bridge.
Reserved I/O	Value	Reserved I/O (4K/8K/12K/16K/20K) Range for this Root Bridge.

6.1.9.2 USB Configuration Submenu

Feature	Options	Description

Feature	Options	Description
XHCI Pre Boot Driver	Enabled, Disabled	Enable or disable XHCI Pre-Boot Driver support.
XHCI Mode	Smart Auto, Auto, Enabled, Disabled	Mode of operation of xHCI controller.
HS Port #1 - #4 Switchable	Enabled, Disabled	Allows for HS port switching between XHCI and EHCI. If disabled, port is routed to EHCI. If HS port is routed to xHCI, the corresponding SS port is enabled.
XHCI Streams	Enabled, Disabled	Enable or disable xHCI Maximum Primary Stream Array.
EHCI 1 (Ports 0-5)	Enabled, Disabled	Control the USB EHCI (USB 2.0) functions. One EHCI controller must always be enabled.
EHCI 2 (Ports 6-7)	Enabled, Disabled	Control the USB EHCI (USB 2.0) functions. One EHCI controller must always be enabled.
USB Port #x Disable	Enabled, Disabled	Disable USB port.

6.1.9.3 PCH Azalia Configuration (HD Audio)

Feature	Options	Description
Azalia	Auto, Enabled, Disabled	Control Detection of the Azalia device. Disabled = Azalia will be unconditionally disabled Enabled = Azalia will be unconditionally Enabled Auto = Azalia will be enabled if present, disabled otherwise.
Azalia Docking Supp	Enabled, Disabled	Enable or disable Azalia Docking Support of Audio Controller.
Azalia PME	Enabled, Disabled	Enable or disable Power Management capability of Audio Controller.
Azalia Internal HDMI	Enabled, Disabled	Enable or disable internal HDMI codec for Azalia.
Azalia HDMI codec Port B	Enabled, Disabled	Enable or disable internal HDMI codec Port for Azalia.
Azalia HDMI codec Port C	Enabled, Disabled	Enable or disable internal HDMI codec Port for Azalia.
Azalia HDMI codec Port D	Enabled, Disabled	Enable or disable internal HDMI codec Port for Azalia.

6.1.9.4 Security Information

Feature	Options	Description
SMI Lock	Enabled, Disabled	Enable or disable SMI lockdown.
BIOS Lock	Enabled, Disabled	Enable or disable BIOS lock enable (BLE) bit.
GPIO Lock	Enabled, Disabled	Enable or disable GPIO lockdown.
BIOS Interface Lock	Enabled, Disabled	Enable or disable BIOS Interface lockdown.
RTC RAM Lock	Enabled, Disabled	Enable or disable bytes 38h-3Fh in the upper and lower 128-byte bank of RTC RAM lockdown.

6.1.10 System Agent (SA) Configuration

Feature	Options	Description
VT-d	Enabled, Disabled	Check to enable VT-d function on MCH.
CHAP Device (B0:D7:F0	Enabled, Disabled	Enable or disable SA CHAP Device.
Thermal Device (B0:D4:F0)	Enabled, Disabled	Enable or disable SA Thermal Device.
Enable NB CRID	Enabled, Disabled	Enable or disable NB CRID Workaround.
BDAT ACPI Table Support	Enabled, Disabled	Enables support for the BDAT ACPI table.
Graphics Configuration	Submenu	Config Graphics settings.
DMI Configuration	Submenu	DMI Configuration settings.
NB PCIe Configuration	Submenu	NB PCIe Configuration settings.
Memory Configuration	Submenu	Memory Configuration settings.
Memory Thermal Configuration	Submenu	Memory Thermal Configuration settings.
GT- Power Management Control	Submenu	GT- Power Management Control settings.

6.1.10.1 Graphics Configuration

Feature	Options	Description
Graphics Turbo IMON C	Value	Graphics turbo IMON current values supported (14-31)
Primary Display	Auto, IGFX, PEG, PCI	Select which of IGFX/PEG/PCI Graphics device should be Primary Display.
Internal Graphics	Auto, Disabled, Enabled	Keep IGD enabled based on the setup options.
GTT Size	1MB, 2MB	Select the GTT Size
Aperture Size	128MB, 256MB, 512MB	Select the Aperture Size
DVMT Pre-Allocated	32-512MB (in 32MB steps), 1024MB	Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
DVMT Total Gfx Mem	128M, 256M, MAX	Select DVMT5.0 Total Graphic Memory size used by the Internal Graphics Device.
Gfx Low Power Mode	Enabled, Disabled	This option is applicable for SFF only.
Graphics Performance Analyzer	Enabled, Disabled	Enable or disable Intel Graphics Performance Analyzer Counters
LCD Control	Submenu	LCD Control

6.1.10.2 LCD Control Submenu

Feature	Options	Description
Primary IGFX Boot Display	VBIOS Default, CRT, EFP, LFP, EFP 3, EFP 2, LFP	Select the Video Device which will be activated during POST. This has no effect if external graphics present. Secondary boot display selection will appear based on your selection. VGA modes will be supported only on primary display

Feature	Options	Description
LCD Panel Type	640x480 800x600, 1024,768, **1280x1024**, **1400x1050 (RB)** **1400x1050,** **1600x1200,** 1366x768,, **1680x1050,** **1920x1200,** **1440x900**, **1600x900,** 1024x768(INV) 1280x800, **1920x1080**	Select LCD panel used by Internal Graphics Device by selecting the appropriate setup item. **Note: resolutions in bold are 2PPC, all other 1PPC timings**
Panel Color Depth	18bit, 24bit	Select the LFP Panel Color Depth
SDVO-LFP Panel Type	VBIOS Default 1024,768, 1280x1024, 1400x1050, 1600x1200	Select SDVO panel used by Internal Graphics Device by selecting the appropriate setup item.
Panel Scaling	Auto, Force Scalling, Off	Select the LCD panel scaling option used by the Internal Graphics Device.
Backlight Control	PWM Inverted, PWM Normal, GMBus Inverted, GMBus Normal	Backlight Control setting.
LFP Backlight Brightness	0-100%	Backlight Brightness setting.
BIA	Auto, Disabled, Level 1-5	>>Auto: GMCH Use VBT Default; >>Level n: Enabled with Selected Aggressiveness Level.
Spread Spectrum clock	Off, Hardware, Software	>>Hardware: Spread is controlled by chip; >>Software: Spread is controlled by BIOS.
TV1 Standard	VBIOS default, NTSC_x ; PAL_x Secam_x HDTV_x	Select the ability to configure a TV Format
TV2 Standard	VBIOS default, NTSC_x ; PAL_x Secam_x HDTV_x	Select the ability to configure a TV Format

Feature	Options	Description
ALS Support	Enabled, Disabled	Valid only for ACPI. Legacy = ALS Support through the IGD INT10 function. ACPI = ALS support through an ACPI ALS driver.
Active LFP	No LVDS, Int-LVDS, SDVO-LVDS, eDP Port-A, eDP Port-D	Select the Active LFP Configuration. No LVDS:VBIOS does not enable LVDS. Int-LVDS:VBIOS enables LVDS driver by Integrated encoder. SDVO LVDS:VBIOS enables LVDS driver by SDVO encoder. eDP Port-A:LFP Driven by Int-DisplayPort encoder from Port-A. eDP Port-D:LFP Driven by Int-DisplayPort encoder from Port-D(through PCH).
Onboard EDID EEPRIM	Enabled, Disabled	Enable or disable the onboard EDID EEPROM

6.1.10.3 DMI Configuration

Feature	Options	Description
DMI Vc1 Control	Enabled, Disabled	Enable or disable DMI Vc1
DMI Vcp Control	Enabled, Disabled	Enable or disable DMI Vcp
DMI Vcm Control	Enabled, Disabled	Enable or disable DMI Vcp
DMI Link ASPM Control	Disabled, L0s, L1, L0sL1	Enable or disable the control of Active State Power Management on SA side of the DMI Link. Note: For optimal performance let this option disabled.
DMI Extended Synch Co	Enabled, Disabled	Enable or disable the control of Active State Power Management on SA side of the DMI Link.
DMI Gen 2	Auto, Enabled, Disabled	Enable or disable the control of Active State Power Management on SA side of the DMI Link.

6.1.10.4 NB PCIe Configuration

Feature	Options	Description
PEG0 – Gen X	Auto, Gen1, Gen2, Gen3	Configure PEG0 B0:D1:f0 Gen1-Gen2-Gen3
PEG ASPM	Disabled, Auto, ASPM L0s, ASPM L1, ASPM L0sL1	Control ASPM support for the PEG Device. This has no effect if PEG is not the currently active device.
ASPM L0s	Root Port Only, Endpoint Port Only, Both Root and Endpoint Ports, Disabled	Enable PCIe ASPM L0s.
Enable PEG	Disabled, Enabled, Auto	To enable or disable PEG.
Detect Non-Compliance Device	Enabled, Disabled	Detect Non-Compliance PCI Express Device in PEG
De-emphasis Control	-6 dB, -3,5dB	Both Root and Endpoint Ports
PEG Sampler Calibrate	Auto, Enabled, Disabled	Enable or disable PEG Sampler Calibrate. Auto means disabled for SNB MB/DT. ENbaled for IVB A0 B0.
Swing Control	Full, Half, Reduced	Perform PEG Swing Control, on IVB C0 and later.
Fast PEG Init	Enabled, Disabled	Enable or disable Fast PEG Init. Some optimization if no PEG devices present in cold boot.
RxCEM Loop back	Enabled, Disabled	Enable or disable RxCEM Loop back.
RxCEM Loop back lane	Lane 0 - 15	Selection RxCEM Loop Back lane

6.1.10.5 Memory Configuration

Note: Changing these setup options can cause the system to become unstable

Feature	Options	Description
Memory Information	Informative	Displays Information about installed Memory
DIMM profile	Default DIMM profile, Custom Profile, XMPprofile1, XMP profile 2	Select DIMM timing profile that should be used

Feature	Options	Description
Memory Frequency	Auto, 1067, 1333, 1600, 1867, 1867, 2133, 2400, 2667	Maximum Memory Frequency selections in MHz.
ECC Support	Enabled, Disabled	Enable or disable DDR Ecc Support
Max TOLUD	Dynamic, 1GB to 3.25 GB in 0.25GB steps	Maximum Value of TOLUD. Dynamic assignment would adjust TOLUD automatically based on largest MMIO length of installed graphic controller
NMode Support	Auto, 1N Mode, 2N Mode	NMode Support Option.
Memory Scrambler	Enabled, Disabled	Enable or disable Memory Scrambler support.
MRC Fast Boot	Enabled, Disabled	Enable or disable MRC fast boot.
Force Cold Reset	Enabled, Disabled	Force cold reset or choose MRC cold reset mode, when cold boot is required during MRC execution. Note: If ME 5.0MB is present, Force cold reset is required!
DIMM Exit Mode	Auto, Slow Exit, Fast Exit	DIMM Exit Mode Control
Power Down Mode	No Power Down APD, PPD, APD-PPD	Power Down Mode Control
Scrambler Seed Generation Off	Enabled, Disabled	Control Memory Scrambler Seed Generation. Enable - do not generation scrambler seed. Disable - Generation scrambler seed always.
Memory Remap	Enabled, Disabled	Enable or disable memory remap above 4G.
Memory Alias Check	Enabled, Disabled	Enable or disable Memory Alias Check
Channel A DIMM Control	Enable Both DIMMS, Disable DIMM0, Disable DIMM1, Disable both DIMM	Enable or disable DIMMs on channel A.
Channel B DIMM Control	Enable Both DIMMS, Disable DIMM0, Disable DIMM1, Disable both DIMM	Enable or disable DIMMs on channel B.

6.1.10.6 Memory Thermal Configuration

Feature	Options	Description
Memory Thermal Management	Enabled, Disabled	Enable or disable Memory Thermal Management.
PECI Injected Temperature	Enabled, Disabled	Enable or disable memory temperatures to be injected to the processor via PECI.
EXTTS# via TS-on-Board	Enabled, Disabled	Enable or disable routing TS-on-Board's ALERT# and THERM# to EXTTS# pins on the PCH.
EXTTS# via TS-on-DIMM	Enabled, Disabled	Enable or disable routing TS-on-DIMM's ALERT# to EXTTS# pin on the PCH.
Virtual Temperature Sensor (VTS)	Enabled, Disabled	Enable or disable Virtual Temperature Sensor (VTS).

6.1.10.7 GT – Power Management

Feature	Options	Description
RC6(Render Standby)	Enabled, Disabled	Check to enable render standby support.
RC6+ (Deep RC6)	Enabled, Disabled	Check to enable Deep RC6 support.

6.1.11 Boot

Feature	Options	Description
Setup Prompt Timeout	1-65535sec	Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.
Bootup NumLock State	On, Off	Select the keyboard NumLock state
Quiet Boot	Enabled, Disabled	Enables/Disables Quiet Boot option
Fast Boot	Enabled, Disabled	Enables/Disables boot with initialization of a minimal set of devices required to launch active boot option. Has no effect for BBS boot options. For more information see also technotes in chapter 6.7
Option ROM Messages	Force Bios, Keep current	Set display mode for option ROM
GateA20 Active	Upon Request, Always	UPON Request – GA20 can be disabled using BIOS services. Always – do not allow disabling GA20; this option is useful when any RT code is executed above 1MB
Interrupt 19 Response	Immediate, Postponed	Bios reaction on INT19 trapping by Option Rom: Immediate – execute the trap right now Postponed – execute the trap during legacy boot
Launch CSM	Enable, Disable	This option controls if CSM will be launched
Boot option filter	UEFI and Legacy, Legacy only, UEFI only	This option controls what devices system can boot to.
Launch PXE OPROM policies	Do not launch, UEFI only, Legacy only	Controls the execution of UEFI and Legacy PXE OPROM
Launch Storage OPROM	Do not launch, UEFI only, Legacy only	Controls the execution of UEFI and Legacy Storage OPROM
Onboard PATA Controller OPROM	Disabled, Enabled	Enable or disable boot option for onboard PATA controller **Note: This option is only available on CXB-6S**
Launch Video OPROM	Do not launch, UEFI only, Legacy only Legacy first UEFI first	Controls the execution of UEFI and Legacy Video OPROM.

Feature	Options	Description
Other PCI device ROM	UEFI Oprom Legacy Oprom	For PCI devices other than Network, Mass storage or Video defines which Oprom to launch
Boot Option #1…	Device x	Set the system boot order Note: The number of available Boot options is dependent on the devices which are connected.

6.1.12 Security

Feature	Options	Description
Administrator Password	Set Password	Set Setup Administrator Password
User Password	Set Password	Set User Password
HDDSecurity Configuration	Set Password	Set HDD Password

6.1.13 The Save & Exit Menu

The following sections describe each of the options on this menu.

Save Changes and Exit

After making your selections in the setup menus, always select "Exit Saving Changes". This procedure stores the selections displayed in the menus in a flash. The next time you boot your computer, the BIOS configures your system according to the setup selections stored in flash. If you attempt to exit without saving, the program asks if you want to save before exiting. During boot-up, the Aptio BIOS attempts to load the values saved in flash. If those values cause the system boot to fail, reboot and press <ESC or DEL> to enter Setup. In Setup, you can get the Default Values (as described below) or try to change the selections that caused the boot to fail.

Discard Changes and Exit

Exit system setup without saving any changes.

Save Changes and Reset

When you have completed the system configuration changes, select this option to save the changes and reboot the system, so the new system configuration parameters can take effect.

Discard Changes and Reset

Select this option to quit Aptio™ TSE without making any modifications to the system configuration

Save Changes

Selecting “Save Options” saves all the selections without exiting Setup. You can return to the other menus if you want to review and change your selections.

Discard Changes

Discard changes done so far to any of the setup options

Restore Defaults

Restore/load default values for all the setup options

Restore User Defaults

Restore the User defaults to all the setup options.

Save as User Defaults

Save changes done so far as User defaults.

Boot Override

It will display all the available boot options from the Boot Option List. The user can select any of the options to select to the particular device and boot directly from it.

Launch EFI Shell from filesystem device

Attempts to Launch EFI Shell application (Shellx64.efi) from one of the available filesystem devices.

6.2 BIOS and Firmware Update

If a System-BIOS update is required please follow these instructions:

- **Bios Update from DOS:**

- Create a bootable DOS disk, USB Stick or hard disk and unpack the update tool AFUDOS.exe from AFUx64_301.msi
- Copy the files “afudos.exe”, “uefi.rom” and “update.bat” to this device.
- Boot the system from this device.
- Type “update” to update the System Bios.
- When the Bios update has finished, reboot the system.

- **Bios Update under Windows:**

- Copy the afuwingui.exe, amifldrv32.sys and the bios image uefi.rom to a storage media (e.g. USB stick).
- Boot Windows XP or Windows 7.
- Copy the 3 files from your storage media to your Harddisk
- Run afuwingui.exe. Make sure that no other application is running to avoid crashes during the update procedure.
- Select “Open” and choose the bios image file uefi.rom.
- After it has opened, a new Tab Window will be displayed where you can choose what block options should be updated. To make sure all relevant updates will be updated, select “Program all Blocks”. All Blocks should be marked now.
- Click the Button “Flash” and Bios update will start.
- After update is finished (all blocks are green), restart your system.

Note: The Amiflash tool for windows can be downloaded from www.ami.com

- **Bios Update from EFI Shell**

Create a FAT32 formatted removable device and unpack the update tool AfuEfix64.efi from AFUx64_301.msi

- Copy an EFI Shell (shellx64.efi) into the root directory of the device.
- Copy the files “Afuefix64.efi”, “uefi.rom”, “update.nsh” to this device.
- Enter System setup and under the menu bar “Save and Exit” choose Launch EFI Shell from filesystem device.
- After Shell is loaded, type:

  - fs0:

  - update.nsh

- When the Bios update has finished, reboot the system.

Note: If an EFI Shell is needed for Bios updates, please contact MSC Technical support.

Note: After the system has been updated, the setup settings will be changed to defaults and therefore it may be necessary to enter Setup to reconfigure the system settings.

6.3 Blind Restoration of Bios default settings (no display available)

- Power up the System
- Repeatedly press DEL for several seconds
- Press F3 for default settings or F2 for previous values.
- Press Enter
- Press F4
- Press Enter
- System will restart

6.4 Restore Bios settings from file

It is possible to save configured Bios settings and copy these settings to other boards which have the same Bios version.

- Configure the setup as required
- Load DOS or EFI Shell with afudos.exe (for DOS) or afuefix64.efi (for EFI Shell).
- Run afudos.exe/afuefix64.efi with following switch to save current Bios:

  Afudos.exe filename /o

  Afuefix64.efi filename /o
- To copy these Bios settings onto another module run afudos.exe or afuefix64.efi with following switch:

  Afudos.exe filename /n /R

  Afuefix64.efi filename /n /R

  Only the Bios settings will be updated without flashing the complete Bios.

  If complete Bios update is also needed, additional switches are needed :

  Afudos.exe filename /p /b /n /x

  Afuefix64.efi filename /p /b /n /x

6.5 Bios Recovery

If an Bios update will be interrupted (e.g. due to power loss) and the update has not been finished, it can be that the system will not boot. In this case it is possible to restore the Bios with the following method:

1. Copy the bios file uefi.rom in the root folder of an USB stick.
2. Connect the USB stick with the system which was not correctly updated.
3. Short the recovery jumpers as seen in chapter 3.1 and
   turn on system. Wait until you see the bios setup screen with the recovery options, then disconnect shorted jumpers
4. Check that “Reset NVRAM” and “Main Block Update” is enabled.
5. Select “Proceed with flash update”
6. Bios will be restored.

6.6 Post Codes

For Post Code information please contact MSC Technical Support
Email: support@msc-technologies.eu
Phone: +49 8165 906-200

6.7 Tech Notes

1. Intel® Rapid Storage Technology

With Intel Rapid Storage Technology you can take use of the advantages of AHCI and RAID.

Through AHCI, storage performance is improved with Native Command Queuing (NCQ). AHCI also delivers longer battery life with Link Power Management (LPM), which can reduce the power consumption of the chipset and Serial ATA (SATA) hard drive.

By enabling Raid you have the possibilities of using Raid 0, Raid 1, Raid 5 and Raid 10.

- RAID 0 uses the read/write capabilities of two or more hard drives working together to maximize storage performance. The hard drives in a RAID 0 volume are combined to form one volume which appears as a single virtual drive to the operating system. For example, four 120GB hard drives in a RAID 0 array will appear as a single 480GB hard drive to the operating system.
- A RAID 1 array contains two hard drives where the data between the two is mirrored in real time. Because all of the data is duplicated, the operating system treats the usable space of a RAID 1 array as the maximum size of one hard drive in the array. For example, two 120GB hard drives in a RAID 1 array will appear as a single 120GB hard drive to the operating system.
- A RAID 5 array is three or more hard drives with data divided into manageable blocks called strips. The main benefits of RAID 5 are storage capacity and data protection.
- A RAID 10 array uses four hard drives to create a combination of RAID levels 0 and 1 by forming a RAID 0 array from two RAID 1 arrays.

To select the Raid mode desired, enter setup and enable Raid in the Sata Submenu under Advanced. Exit the setup with F4. System will restart and you will be prompt to enter CTRL-I to open Raid GUI. Here you can configure your connected Raid disks and select the raid mode. On Windows systems it is recommended to install the Intel Rapid Storage Device drivers.

Note: Using AHCI or Raid needs to install AHCI/Raid drivers during setup of Windows XP by pressing F6when setup starts. The drivers must be available on an USB FD Drive.

2. Intel Rapid Start

Using this technology wakes your system from a S4 sleep state nearly as fast as from S3.

If your system is in S0 and you enter S3, the system will wake up from S3 and saves all the memory to a special partition on a SSD and then the system will enter S4. After resuming from S4 all saved memory content will be written back from SSD to Ram. The advantage with this simulated S3 is power saving.

3. EIST (Enhanced Intel Speed Step)

This allows the processor to meet the instantaneous performance needs of the operation being performed, while minimizing power draw and heat dissipation. Processor clock will be at it’s minimum possible frequency when in IDLE. When performing CPU loads, it will change its frequency up to its maximum frequency.

Note: If EIST is disabled in setup, the CPU will run at its maximum speed. Turbo Boost Technology won’t be available.

4. Turbo Boost Technology 2.0

Intel Turbo Boost is a technology that enables the processor to run above its base operating frequency via dynamic control of the CPU's "clock rate". It is activated when the operating system requests the highest performance state of the processor. The increased clock rate is limited by the processor's power, current and thermal limits, as well as the number of cores currently in use and the maximum frequency of the active cores.
For more information about Intel® Turbo Boost 2 Technology visit the Intel® website.

Note: Turbo Boost will only work if EIST is enabled.

5. ASPM (Active State Power Management)

Active State Power Management or ASPM is a power management protocol used to manage PCI Express-based serial link devices as links become less active over time. As serial-based PCIe bus devices, such as IEEE1394 (FireWire), become less active, it is possible for the computer's power management system to take the opportunity to reduce overall power consumption by placing the link PHY into a low-power mode and instructing other devices on the link to follow suit.

6. TXT (Trusted Execution Technology)

Due to the complexity of this feature, please visit
http://www.intel.com/content/dam/www/public/us/en/documents/white-papers/trusted-execution-technology-security-paper.pdf

Note: To use this feature VT, Vt-d, SMX and TPM must be enabled.

7. IAMT (Intel Active Management Technology)

Intel Active Management Technology (AMT) is a technology for remotely managing and securing PCs out-of-band. With AMT it is possible to remotely power up, power down, power cycle and reset the client computer. Complete Systeminformation (Hardware, Software, System Log) is remotely available for the Administrator. It is also possible to remote boot the PC and redirect to a CD-ROM, DVD or other boot device that is connected on the host pc. This is usefull if the PC has a corrupted or missing OS. Also it is possible to remotely redirect to the systems bios via console redirection through serial over LAN (SOL). This feature supports remote repair, remote troubleshooting, remote repair, software upgrades and so on.

8. Intel VT and VT-d

Increasing manageability, security, and flexibility in IT environments, virtualization technologies like hardware-assisted Intel® Virtualization Technology (Intel® VT) combined with software-based virtualization solutions provide maximum system utilization by consolidating multiple environments into a single server or PC. By abstracting the software away from the underlying hardware, a world of new usage models opens up that reduce costs, increase management efficiency, strengthen security, while making your computing infrastructure more resilient in the event of a disaster.
For more information about the technology please visit:
http://www.intel.com/technology/virtualization/

VT-d supports the remapping of I/O DMA transfers and device-generated interrupts. The architecture of VT-d provides the flexibility to support multiple usage models that may run un-modified, special-purpose, or "virtualization aware" guest OSs. The VT-d hardware capabilities for I/O virtualization complement the existing Intel® VT capability to virtualize processor and memory resources. Together, this roadmap of VT technologies offers a complete solution to provide full hardware support for the virtualization of Intel platforms.

9. Fast Boot

Fast Boot supported by Aptio provides faster boot time by learning the system configuration on the first boot. On the Next boot system boots faster because the bios will only use the best boot path from the first OS boot. It configures only devices needed for the OS to boot. It adapts when system changes.

10. Trusted Platform Module (TPM)

A TPM is a cryptoprocessor that can store cryptographic keys that protect information.

The Trusted Platform Module offers facilities for the secure generation of cryptographic keys, and limitation of their use, in addition to a hardware pseudo-random number generator. It also includes capabilities such as remote attestation and sealed storage.

- "Remote attestation" creates a nearly unforgeable hash-key summary of the hardware and software configuration. The program encrypting the data determines the extent of the summary of the software. This allows a third party to verify that the software has not been changed.
- "Binding" encrypts data using the TPM endorsement key, a unique RSA key burned into the chip during its production, or another trusted key descended from it.
- "Sealing" encrypts data in similar manner to binding, but in addition specifies a state in which the TPM must be in order for the data to be decrypted (unsealed).

Software can use a Trusted Platform Module to authenticate hardware devices. Since each TPM chip has a unique and secret RSA key burned in as it is produced, it is capable of performing platform authentication. For example, it can be used to verify that a system seeking access is the expected system.

11. List of references

4. Turbo Boost
http://en.wikipedia.org/wiki/Intel_Turbo_Boost
5. ASPM
http://en.wikipedia.org/wiki/Active_State_Power_Management
8. Intel Vt and VT-d
http://ark.intel.com/VTList.aspx
http://www.intel.com/technology/itj/2006/v10i3/2-io/7-conclusion.htm
10. TPM
http://en.wikipedia.org/wiki/Trusted_Platform_Module

7 EAPI

The "Embedded Application Programming Interface" (EAPI) used by this module provides a standardized interface for customer applications. This interface allows a user mode application access to hardware specific information as well as hardware resources. Following features are supported:

- view board information
- access to NVRAM
- access to I2C
- control GPIO's
- control backlight
- set watchdog timer
- view sensor values of hardware monitor

MSC provides a software package which is downloadable here after registration

http://www.msc-technologies.eu/support/boards

8 Troubleshooting

Problem 1: USB 3.0 stick causes hang at boot time

Some USB 3.0 sticks/disks may cause BIOS hang at post code 0xB4, if XHCI mapping mode is not set to *enabled*.

Solution:

Please check for firmware update of the USB device. Alternatively the setting for XHCI mapping mode could be changed to *enabled* in the BIOS setup.

Problem 2: USB stick recognized as floppy

Some USB sticks are recognized as floppies (show up as "A:" drive under DOS). If this is not wanted, there is a way to handle such an USB stick as a fixed disk (int13h device 8xh).

Solution:

Check in BIOS setup under *Advanced -> USB Configuration* and at the bottom it should have a list of USB mass storage devices. Here you can choose between *Floppy, Forced Floppy, Hard Disk or CD ROM* behavior of your USB stick.

Problem 3: SATA 6Gb/s

SATA 6Gb/s behavior is functional only with SATA 6Gb/s cable.

Solution:

Use SATA 6Gb/s cable.

For additional help please contact MSC Technical Support:
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